The Aviation Historian®

The modern journal of classic aeroplanes and the history of flying

GOLDEN YEARS

A LIFE FLYING WITH THE RCAF

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Editor's Letter

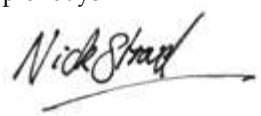
FIRST, AND MOST importantly, we hope that all our readers, contributors, advertisers, supporters and followers in the UK and around the world are managing to weather the Corona-virus pandemic and are keeping safe and well.

Thankfully for us here at *TAH*, it's been very much business as usual. Although (maybe even because) there have been no airshows to attend, nor museums or restoration workshops open to visit, we have seen a healthy uptick in the number of people ordering subscriptions and back-issues (even full sets). This pause in normal life has evidently provided us all with time to catch up and even expand — finally — on the reading we love to do. Silver linings and all that . . .

Nevertheless, it has been a strange three months since I sat down to write my *Editor's Letter* for *TAH31* in late March, just as we were being instructed here in the UK to prepare for an indefinite period stuck indoors, with similar directives being issued more-or-less globally. Now, 86 days after the beginning of the lockdown as I write this, there is cause to be hopeful that things may be returning to some semblance of normality. On the downside, although this year sees a number of significant anniversaries — including the 80th anniversary of the Battle of Britain and the 75th anniversary of both VE- and VJ-Days — it seems extremely unlikely that we will be able to celebrate and commemorate them as we might wish. In this issue we mark the first of those anniversaries with Greg Baughen's tribute to "The Few", forced to fight a different war from the one they had been preparing for, forging fighting tactics "on the hoof" almost daily — which makes their contribution to Britain's survival all the more remarkable. His article leads us off on page 10.

Finally, the usual reminder that everything we cover in *TAH* — including artworks and book reviews — is included in our index, available (FREE!) as a PDF download from the *TAH* website. It's well worth exploring.

Best wishes for blue skies and happier days.



FRONT COVER ***Corporal George Hardy's breathtaking photo of the RCAF's Golden Hawks, led by Wg Cdr Fern Villeneuve AFC, in their gleaming Canadair Sabres, inverted over Niagara Falls in 1959.*** DND

BACK COVER ***The sole SIAI-Marchetti S.84 at Zürich. Maurice Wick-stead's history of Italy's airlines continues on page 22.*** VIA ROB MULDER

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AIR CORRESPONDENCE

Letters to the Editor

Burma & The Hump – I was there

SIR — I read with great interest Tom Culbert's article *The Hump Pioneers* in *TAH31*. On coming to the crossheads "Japan Takes Rangoon" and "The Fall of Myitkyina", it brought back vivid childhood memories from that time, during which I lived at both locations.

You may be interested — as may some readers — to know that I am the sole survivor of family members evacuated in an RAF Dakota in April 1942 from Myitkyina to the safety of Calcutta before the Japanese captured this last airfield that was still in British hands until May 5, 1942.

Having been born in Rangoon in 1937 and resident there with my parents until late January 1942 — when the second heavy Japanese bombing raid on Rangoon took place — I and my mother, her elder sister Lucy and her husband had to leave all our furniture and valuable possessions behind on the road journey to Mandalay, where we stayed temporarily at the house of old family friends.

Aged five, I remember (as if it were yesterday) watching with my uncle from the first floor living-room window, wave after wave of twin-engined Japanese bombers, three abreast, on a course directly approaching the house, dropping their bombs in unison on the very first Japanese raid on Mandalay on Good Friday, April 4, 1942.

Where others lose their heads and panic when faced with unexpected danger, my mother always kept calm. In a matter of minutes she decided it was too dangerous to remain in the all-timber house and ushered us all down the rickety wooden rear staircase into the compound at the back of the building. Hardly had we half-walked, half-run some 150–200yd down the burning-hot pavement (there was no time for lunch at noon), when we heard a terrific explosion behind us. On turning round, we witnessed the whole house — that we had left not more than five minutes previously — going up in a huge ball of red and yellow flames from a direct bomb hit. Had it not been for my mother's presence of mind, I would not be here today to relate this.

On that same day, I recall that we journeyed by road up to Myitkyina. As this little village became overwhelmed with British evacuees (we were not "refugees", as is commonly termed by many), there was only enough accommodation to house the ailing and elderly, so my mother and I had no choice but to sleep at night in the jungle under the trees and stars, with a myriad of mosquitoes for company.

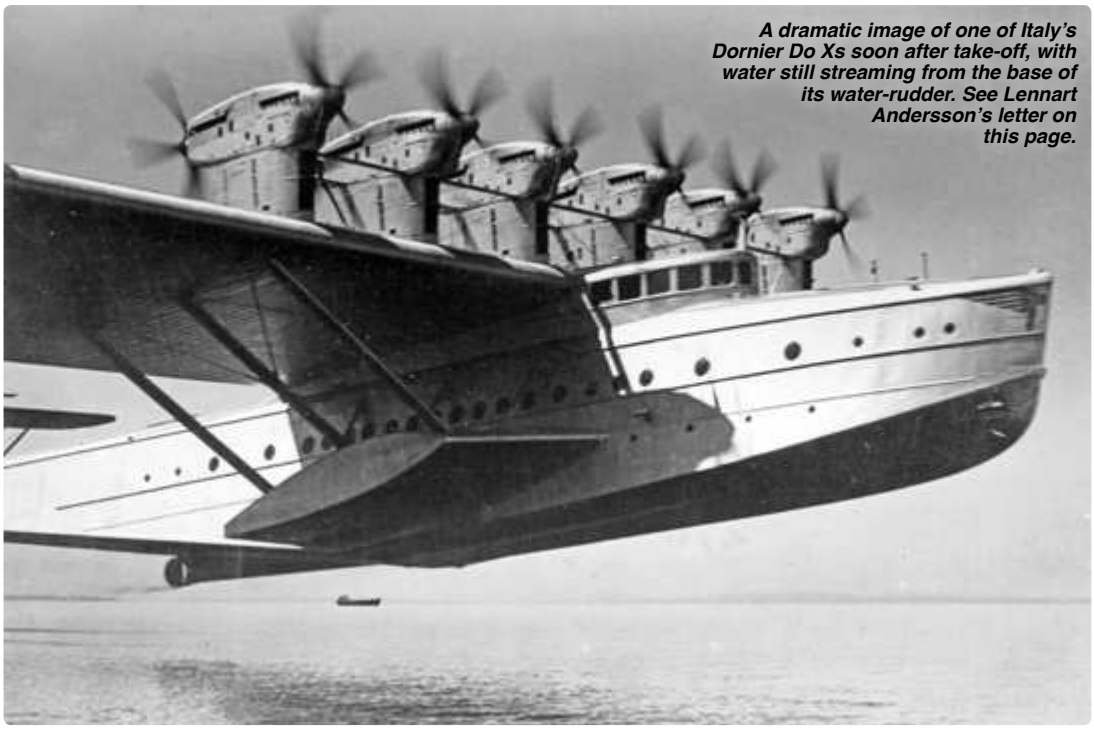
Each day we examined the roster to see if our names were on a flight scheduled for the following day; it was during the waiting period that I caught malaria in the jungle, and on arrival in Calcutta I was rushed to hospital with a temperature of 104°F. I remember the doctor telling my mother, when she visited the next morning, that he was pleased he was able to prevent my temperature climbing further during the night. "If it had risen just one degree more, your son would not have survived."

After several days in hospital, where I remember bags of crushed ice being placed on my feet, knees, stomach, outstretched hands and on my forehead, I pulled through, but suffered three relapses before the war ended.

My mother having sadly passed away in London a few days before her 97th birthday in 2002, I may well be the sole remaining survivor who was on one of those dangerous evacuation flights "over the Hump" in April 1942.

As a devoted aviation enthusiast since the age of seven, in the early 1950s I was able to identify for myself the Japanese bombers that I had seen directly approaching the house on an east–west course over Mandalay on Good Friday, 1942. On first seeing them, I was struck by the fact that their slim fuselages were dwarfed by the large-diameter radial engines on both sides. Since the tailplanes did not sport twin fins and rudders at their extremities, and as Mandalay is in the centre of Burma, I concluded they could not have been the twin-finned IJNAF Mitsubishi G3M *Nell* nor the rotund-fuselage Mitsubishi G4M *Betty*, but must have been the slim-fuselage IJAAF Kawasaki Ki-48 *Lily*.

Although this raid was briefly mentioned by



A dramatic image of one of Italy's Dornier Do Xs soon after take-off, with water still streaming from the base of its water-rudder. See Lennart Andersson's letter on this page.

LUIGINO CALIARO COLLECTION x 2

Christopher Shores *et al* in *Bloody Shambles Vol 2* (Grub Street, 2000 edition, page 361), the aircraft are not identified. As I may well be the sole surviving British civilian witness of this raid, I dare say there's no-one else who could provide this useful info at first hand.

Ted Oliver *Frankfurt-am-Main, Germany*

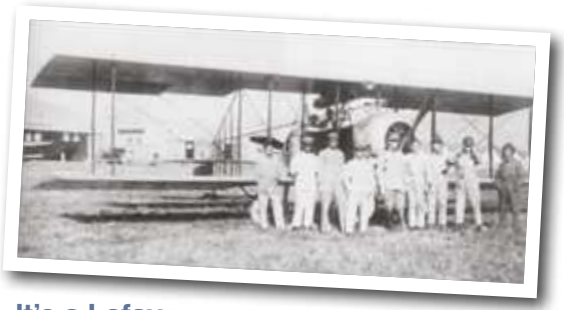
Italy's Dornier Do Xs

SIR — I would like to add some information to Part One of Maurice Wickstead's article *Italy's Forgotten Airlines* in *TAH31*. While SANA had considered the use of the giant Dornier Do X flying-boat, both Italian examples had already in fact been ordered from Dornier's Swiss subsidiary Aero-Metall AG on April 6, 1927, by the *Consorzio Aereo Italiano SA* on behalf of the Italian government. The price was SFr 2,470,000 each. It seems that Dornier's Italian subsidiary, *Società Anonima Costruzioni Meccaniche Aeronautiche* (CMASA), was involved in some way in the transaction as well.

Construction started in 1929 at Altenrhein in Switzerland and delivery was made in August 1931 and April 1932. The civil registrations were never taken up and both aircraft were instead identified by their military serial numbers, MM.182 and MM.208, and/or by their names, *Umberto Maddalena* and *Alessandro Guidoni*.

Lennart Andersson *Uppsala, Sweden*

Do X MM.182* Umberto Maddalena *arrived in Italy in 1931 but never entered airline service, instead being allocated a military identity.



It's a Lafay

SIR — I have to thank retired aviation book dealer Brian Cocks for identifying the aeroplane featured in my *Lost & Found* piece in *TAH31*. It was not a Paul Schmitt aeroplane at all, but an obscure one-off Brazilian machine.

On the day that the Armistice put an end to the Great War, November 11, 1918, the first members of a French Military Mission engaged to organise the Brazilian Army's Aviation School arrived in Rio de Janeiro. Among them was Capt Etienne Lafay, who was to build two aircraft in Brazil. The first was a biplane similar to the French Caudron G.III, powered by an 80 h.p. Gnome rotary engine, and this is the machine featured in the *Lost & Found* picture.

Officially named *Rio de Janeiro*, it was completed in April 1920 and first flew at the Military Aviation School at Campo dos Afonsos on May 15. Three days later it was announced that the aircraft had reached an altitude of 2,200m (7,200ft) in 25min. On August 8 Lafay flew the *Rio de Janeiro* from Rio to São Paulo, returning the next day, and on August 29 he broke the South American endurance record. The aircraft was flown until the end of 1923.

Meanwhile, Lafay built a second, larger, aircraft of similar configuration but powered by a pair of 130 h.p. Clerget rotary engines mounted in a push-pull arrangement in the front and rear of the nacelle (**ABOVE LEFT**). Named *Independencia*, it first flew on May 25, 1922.

Philip Jarrett *Dorking, Surrey*

Swapping seats in a B-24

SIR — Thank you for *TAH31*. Brian Turpin's *Brief Encounter* article on Dave Tallichet's Consolidated B-24 was very interesting indeed. I met Dave on more than one occasion and flew with him twice in his B-17, once at Duxford during the filming of *Memphis Belle* and again in the USA, two years later. He always wore light-coloured open-neck shirts with either short sleeves or sleeves rolled up, and would wear glasses most of the time. The photograph on page 129 says that Dave is sitting in the right-hand seat. I disagree, as the person on the left looks more like Dave, grey hair included!

Having stood behind him in the B-17, it certainly looks like the back of him. Brian was shorter and had darker hair too.

Andy Height *Welney, Norfolk*

BELOW ***This B-24 Liberator cockpit image from*** **TAH31** ***shows*** **Delectable Doris's** ***owner David Tallichet in the left-hand seat and Brian Turpin on the right; we got them the wrong way round in our original caption — see Andy Height's letter on this page. Brian has added interest to the correction by kindly sending us the picture at*** **RIGHT.** ***He says, "Attached is a photo of David (left), Clive Denney and myself at Binbrook on August 6, 1989, just prior to leaving for Prestwick en route to Buffalo. We are standing under the nose of Boeing B-17 Flying Fortress*** **Memphis Belle.** ***Behind is*** **Sally B** ***pretending to be the*** **Belle.** ***Clive was on the trip as flight engineer and relief pilot".***

Doris and Duxford

SIR — The piece by Brian Turpin in *TAH31* brought back a few memories of my brief association with B-24 *Delectable Doris*.

I was studying at Cambridge University during 1973–76 when *Doris* appeared at Duxford airfield. I quickly joined the EAAS — the East Anglian Aviation Society, who at that time were allowed access to the IWM (Imperial War Museum) collection of stored aircraft at Duxford — and turned up there one Sunday expressing my wish to work on that magnificent aeroplane.

I was asked to scrub the wing upper surfaces with paint stripper in a vain attempt to remove whatever the Indian Air Force had applied to *Doris* to protect her from the elements. This involved climbing out of the hatch in which Brian is posing in the photograph at the beginning of the article, then carefully walking along the lines of rivets marking the (flattish) tops of the fuselage and wings to where I was working. No safety harness, no barriers, no non-slip shoes: just care and attention! By coincidence, the Health and Safety at Work Act was passed soon afterwards.

I got to know Norman Ottaway (who drew the maps and contributed preliminary artwork to Roger Freeman's book *The Mighty Eighth*) well, as we both worked on *Doris;* me on her wings, him on her tailplane. I remember two other things: the pair of USAF engineers from either Mildenhall or Lakenheath who regaled us with tall tales while the compressor that they had brought with them pumped up *Doris's* tyres; and being shouted at after taking a group of other volunteers around the inside of the aircraft: their weight nearly tipped *Doris* on to her tailskid! The memory of that still makes me shudder, even after 45 years.

My involvement with Duxford abruptly ended when the EAAS was thrown off the site after a small group broke away to form the DAS (Duxford Aviation Society) and negotiated exclusive access with the IWM. A big meeting in a hangar somewhere (not Duxford) exposed the anger of many EAAS members who had contributed financially and otherwise to the activities at Duxford and who felt very aggrieved by this sudden DAS/IWM *fait accompli*. I decided that historic aircraft, important as they are, shouldn't be used by pedantic obsessives as weapons to upset fellow enthusiasts (behaviour that also poisons the railway preservation movement, by the way); from then on, I became an armchair aviator. One of my last visits to Duxford while I was a student was to witness the arrival of both B-17 *Sally B* (known as *"Euroworld"* at the time) and the last flying Gloster Javelin on April 13, 1975.

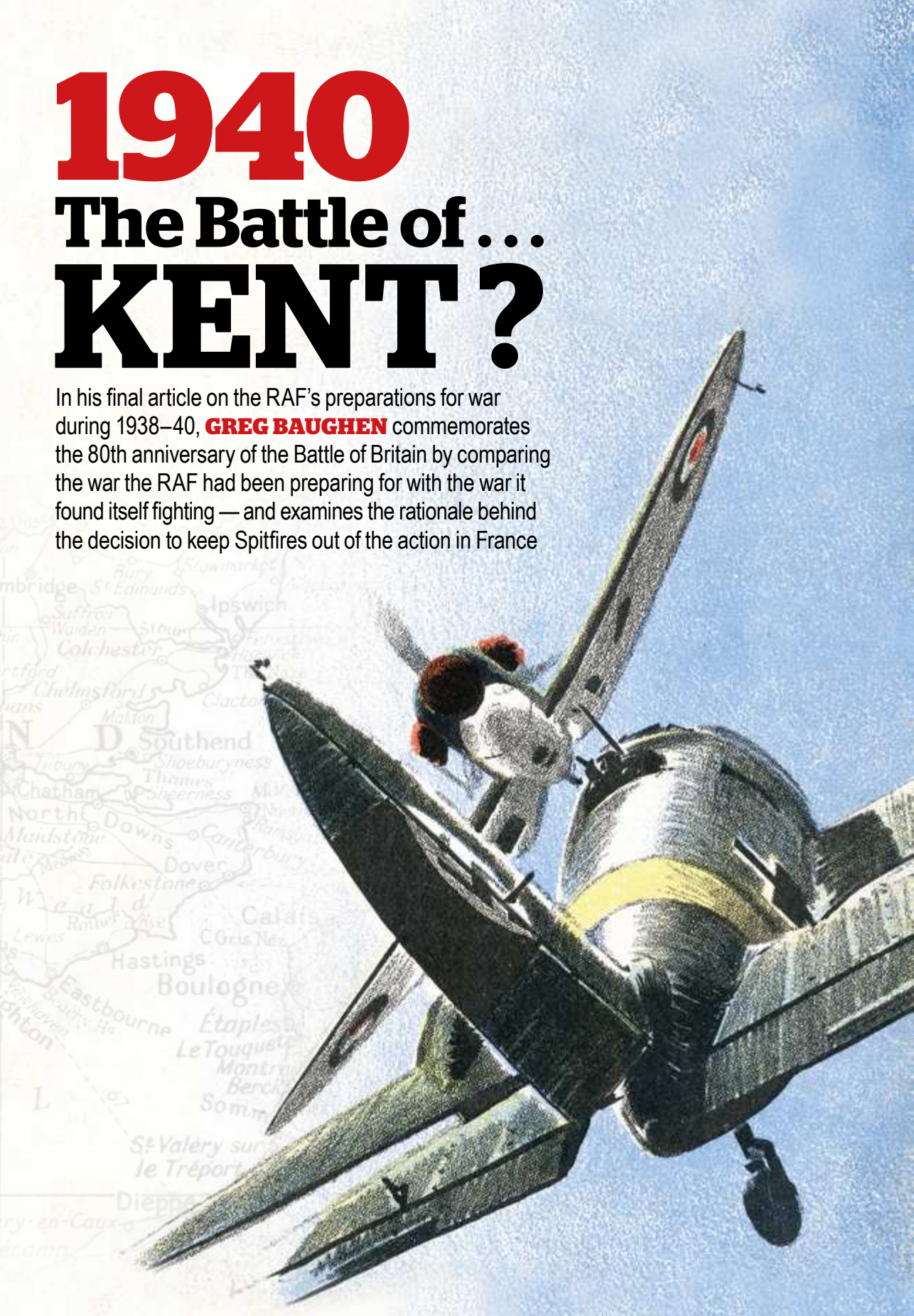
Thanks to you and your team for producing the best aviation magazine in the world: something to cheer us all up as we take enforced shelter from Covid-19!

Mike Provost *Bramcote, Nottingham*

TAH *subscriber Mike Provost sent us these photographs, which he took at Duxford in April 1975 (see his letter on this page). They show newly arrived B-17* Sally B, *still bearing the legend "Euroworld" on its nose (it was actually the name of the ferrying company established by B-17 Preservation Ltd's founder Ted White). David Tallichet's B-24* Delectable Doris *is visible in the background of both images.*

1940
The Battle of … KENT?

In his final article on the RAF's preparations for war during 1938–40, **GREG BAUGHEN** commemorates the 80th anniversary of the Battle of Britain by comparing the war the RAF had been preparing for with the war it found itself fighting — and examines the rationale behind the decision to keep Spitfires out of the action in France



LEFT ***Nicknamed "Stuffy" owing to his often reserved and aloof demeanour, Air Chief Marshal Hugh Caswall Tremenheere Dowding joined the RFC in August 1914. After an accomplished inter-war RAF career he was appointed commanding officer of the newly formed Fighter Command in July 1936, and was on the verge of retirement when the Second World War broke out.***

IN THE SUMMER of 1940 RAF Fighter Command won a glorious victory in the Battle of Britain. The history books tell us that the bravery of "The Few", British technical wizardry and the foresight of Fighter Command's leader, Air Chief Marshal Hugh Dowding, averted disaster and halted the German advance across Europe. Dowding and the pilots he led became national heroes. There is no doubt that it was indeed a glorious victory — but perhaps the glory needs a little redistribution.

A version of events has been created in which Dowding and the British Air Staff, with admirable foresight, always knew that a "Battle of Britain" would have to be fought, and they devoted all their energies to making sure Britain won it. This included a steadfast determination not to fritter away Britain's fighter resources in land battles on the continent of Europe. Dowding's clear thinking and dogged determination ensured that the careful preparations for this decisive battle were not wasted. So this version goes.

Dowding himself was at least partly responsible for ensuring this take on events became the standard version, by means of a despatch he wrote a year after the battle.[1] This has become the starting point for many accounts of the battle and is also the source of many of the misconceptions that surround the events of 1940 today.

Looking back 80 years later, there seems to be a superficial justification for this standard version of events. After all, the Battle of Britain was a decisive battle, Britain did win it and the country went on to win the war. The only problem with this orthodoxy is that the battle fought in the summer of 1940 was not the battle the Air Staff, Dowding and Fighter Command had been so carefully preparing for.

THE DREADED "KNOCKOUT BLOW"

The threat the RAF was designed to deal with was defined long before Dowding took over Fighter Command. Ever since the early 1920s, the much feared "knockout blow" had dominated Air Ministry thinking. Conventional land battles were believed to be a thing of the past. Any attempt to win a war on land would just get bogged down in Great War-style trench warfare. The RAF was designed almost exclusively to deliver a knockout blow and defend the country against the same.

It is difficult now to appreciate fully just how gravely this knockout blow was viewed at the time. In the 1920s and 1930s the prospect of another world war conjured up the same images that a future generation would associate with a nuclear conflict. This was the nightmare scenario that shaped all Air Staff thinking. Unless the scale of the potential catastrophe the country believed it faced is understood, it is difficult to make sense of some of the decisions made by the government and RAF leaders before and during the war.

Britain's first inter-war air defence system was based on the London Air Defence Area (LADA) organisation of the First World War. By the end of the latter, this involved a complex reporting system, using the eyes and ears of observers and the first early-warning sound mirrors. Filter rooms sifted the information and a central control room at Admiralty Arch in London plotted the positions of the attacking aircraft on a flat-laid map; RAF commanders watched events unfold from a raised dais and scrambled squadrons via direct telephone lines to the airfields. Pilots could be kept informed by radio of the latest information as they climbed to meet the enemy. Even in 1918 it was already an extremely sophisticated system.[2]

In the 1920s air defence sectors along the south coast, mirroring the LADA set-up, were created to deal with a French attack. Each sector would

OPPOSITE PAGE ***In 1941 Puffin published Picture Book No 21,*** **The Battle of Britain,** ***a children's book based on the Air Ministry's "Official Account of the Great Days of 1940", written by David Garnett and incorporating a series of pastel artworks by James Gardner, including this dramatic sketch of a head-on meeting of a Spitfire and He 111.***

TAH ARCHIVE

ABOVE ***The Westland Whirlwind was designed to Air Ministry Specification F.37/35, issued in February 1936, for a cannon-armed single-seat day- and nightfighter predominantly for home defence, and had speed and fierce firepower at the heart of its design; the four 20mm cannon in the nose were for knocking down unescorted bombers.***

be patrolled by one squadron, two for sectors defending London. In the 1930s the sector system was switched to the east coast to defend against a German attack and radar began to replace the sound mirrors. This was the system when the Air Defence of Great Britain (ADGB) was divided into Bomber and Fighter Commands in 1936, with Dowding taking over the latter. Dowding continued to refine the system, but it is perhaps somewhat unfair to those who had gone before him to call it the "Dowding System".

It was an air defence system designed to defend the country's population and industrial centres, from Glasgow to London. Fighters were spread around the country accordingly. The struggle the Air Staff was anticipating would have been a true "Battle of Britain". Each sector could only comfortably direct three squadrons against any enemy attack, so there was an upper limit to what the system could accommodate. However, three squadrons per sector was considered ample. An enemy formation crossing any one sector would be met by the squadrons of that sector and the two neighbouring sectors. Nine squadrons comprising a total of around 100 fighters would greet any enemy attack.

It was assumed that for bombers from bases in Germany, the provision of fighter escorts would not be possible. There would therefore be no need for the dogfighting that had characterised air combat over the Western Front in the First World War. Pilots were trained to perform mass attacks in tight formations on unescorted bombers. Skills required for fighter-versus-fighter combat were not part of the British training syllabus. Fighter specifications required bomber-interceptors, not dogfighters. High speed and firepower were the priorities, not manœuvrability.

By the late 1930s the Air Staff was anxious to move away as soon as possible from single-engined machine-gun-armed fighters like the Hawker Hurricane and Supermarine Spitfire, to much larger twin-engined bomber-destroyers with 20mm — perhaps even 40mm — cannon *[see Mark Russell's* Bring Out the Big Guns *in* TAH28 *— Ed.]* Air-to-air rocket projectiles were another possibility that Dowding in particular was keen to promote. There was nothing wrong with the way Dowding and the Air Staff were tackling the bomber threat. These were the tactics and weapons the Luftwaffe would later use to deal with unescorted American daylight raids.

A FORTUNATE DELAY

As things turned out, it was fortunate that specialist bomber-interceptors, like the Westland Whirlwind and Bristol Beaufighter, were behind schedule and that, in 1940, Fighter Command still had fighters as manœuvrable as the Spitfire and Hurricane.[3] Even these lacked the control and manœuvrability required in a high-speed dogfight. This was not a result of poor design; it was simply that these were not qualities required by bomber-interceptors. Neither fighter handled well at high speed, rate of roll was not particularly good and the Rolls-Royce Merlin engine had a nasty habit of cutting out during negative-g manœuvres. None of these factors were issues for bomber-interceptors that only had to fly straight and level. Metal ailerons, clipped wings and an ingenious fuel-flow restrictor would later be introduced to alleviate these problems, but in 1940 pilots had to fight with what they had. They could count themselves lucky they did not have to take on the Luftwaffe's Messerschmitt Bf 109Es in Whirlwinds and Beaufighters.

In the spring of 1939 Dowding's plans were disrupted by the government's decision to send

PHILIP JARRETT COLLECTION

ABOVE ***The main priority for Dowding, and to some extent the Air Staff, in the run-up to war was the establishment of a fighter force capable of stopping German bombers, such as these Heinkel He 111s, from raining destruction on British cities all over the UK from bases in Germany — crucially, beyond the range of German escort fighters.***

a substantial army to support France. Dowding immediately made it clear he did not want any of his fighters to support these ground forces until he had everything he needed to defend the home country. For Dowding — and in principle the Air Ministry agreed with him — German bombers heading across the North Sea were the danger, not German armies advancing through France.

It was clearly impossible to send an army to France without any fighter cover, and Dowding appeared to lose this first round when he agreed to earmark four Hurricane squadrons for this task. However, when war was declared and these squadrons were about to cross the Channel, an order came through from Dowding cancelling the transfer. A baffled Air Ministry immediately wanted to know what was going on. Dowding insisted that in a radio broadcast he had made a promise to the British people that he would protect them, and that by allowing these squadrons to go to France he would be breaking his promise.[4]

Minutes of meetings were produced which clearly showed that Dowding had agreed to the transfer. Yet he remained unmoved. He thought he was on strong ground. In his view, a knockout blow was surely about to come and the wisdom of his defiance would soon become clear as bombs rained down on London. However, the knockout blow did not come; and, as the days passed, Dowding's position became increasingly untenable. After two weeks he had to concede and the four squadrons went to France. Dowding's "Hurricane tap" had been turned on. He was determined that no more should follow them.

THE CALM BEFORE THE STORM

Although on the outbreak of war the expected knockout blow had failed to materialise, it was not immediately obvious that the British Air Staff was getting it wrong. With no fighting on the Western Front, it seemed like the war on land had already reached the predicted stalemate. For the Air Staff, the Luftwaffe's failure to attack Britain was a puzzling but nonetheless welcome reprieve — but it was certain that it *was* only a reprieve.

The Germans, the Air Staff believed, with

Hawker Hurricane Mk I N2479 of No 56 Sqn is inspected at North Weald in 1940. The unit saw action in both the Battle of France and the Battle of Britain, and was one of the few squadrons to remain in the south of the UK throughout the latter. Should Dowding have sent the eminently more suitable Spitfire to France and kept his force of Hurricanes back to take on the Luftwaffe's bombers?

TAH ARCHIVE

BAE SYSTEMS

ABOVE ***Led by Mk Is K9912 (left) and K9910, both hung with "serviceable" signs between their wheels, 16 Spitfires of No 65 Sqn (with immaculately "dressed" propellers) are lined up at the unit's base at Hornchurch. The squadron participated in operations over Dunkirk in May 1940 (during which K9912 was lost) and played a major part in the Battle of Britain.***

their outdated theories of war based on massive armies, might first attempt to win the war on land, as French and British Army generals were assuming, but any such attempt was doomed to fail. If more progressive minds within the German command had any influence, then Germany might skip the doomed land offensive and move straight to the bomber war. Either way, Britain would eventually be the target.

Indeed, Britain might well be first on the Führer's list for attack. Hitler might reason that, with Britain knocked out of the war, France would surely soon throw in the towel. Fighter Command had to be ready. The country could not afford to lower its guard. Any attempt to move fighters elsewhere might be fatal. Bomber Command stood ready to deliver its counter-knockout blow. Nobody saw the real danger — nobody was worrying about Panzer divisions.

In May 1940 the Germans duly launched their ground offensive and, as in Poland, the Panzer/Luftwaffe partnership once again sliced through enemy defences. This time it was the mighty French Army that was discovering how powerful the combination was. Dutch, Belgian, French and British army commanders were all appealing for more fighter cover. The number of squadrons in France was increased to ten but there were still 300 Hurricanes and 350 Spitfires in Britain.

The problem for Dowding was that the knock-out blow was still not coming and his 650 fighters were not contributing anything to a battle in France that was clearly not going well. His counterpart at Bomber Command, Air Marshal Charles Portal, had the same problem. Most of his heavy bombers (Vickers Wellingtons, Handley Page Hampdens and Armstrong Whitworth Whitleys) were not involved in the fighting. As the German Panzers broke though French defences at Sedan, some 350 RAF bombers were standing by, waiting for government permission to launch their first blow in the bomber war — a strike on oil factories in the Ruhr.

The waiting game was fraying Air Ministry nerves. There seemed no point in putting off the inevitable bomber exchange. There was a strong desire to get on with it. Portal was straining at the leash to get his blow in first. Above all, keeping 1,000 aircraft out of a battle in France where they were so obviously needed was becoming an increasingly untenable position. To keep his fighters in Britain, Dowding needed the Luftwaffe to launch an attack, so he set about trying to ensure that it did.

BAITING THE LUFTWAFFE

On May 14, 1940, as French forces desperately tried to seal off the German breakthrough at Sedan, Dowding wrote to Air Marshal Richard Peirse, Vice-Chief of the Air Staff, with a copy to Portal, urging the immediate launching of an air assault on the Ruhr "to draw on to this country air attacks which would otherwise have been

delivered on continental targets". He went on: "I want Fighter Command to pull its full weight in this battle, but I want to do so by shooting down Germans in this country and not France".[5]

It was an extraordinary suggestion. For years, politicians had bent over backwards to appease Hitler just to make sure British cities were spared destruction. Now Dowding wanted to goad the Luftwaffe into attacking Britain so that his fighters could play their part in the Battle of France — without going to France. The cabinet met, with Dowding present. The latter insisted that at current loss rates, his entire Hurricane force would be wiped out in ten days. Dowding reached this extraordinary conclusion by counting every Hurricane that crossed the Channel to join the battle in France as a loss. The cabinet was persuaded, and an attack on the Ruhr was launched.

The Air Staff believed it had delivered a mighty blow. In fact, the attempt to bomb oil factories in the Ruhr was so unsuccessful that the Germans were not even aware that a major attack had taken place. They guessed that the scattered bombing was probably undertaken by training flights with crews dropping a few bombs randomly as an afterthought.[6] No oil factories were hit and one civilian was killed. Even if the Luftwaffe had been capable of launching an air offensive against Britain, this effort scarcely warranted diverting effort from the crucial battle in France.

The lack of any German response puzzled the government and Air Staff; but, having provoked Germany, there was now even less reason to denude Britain's defences by sending more fighters to France. On May 19 all RAF squadrons to the north of the German breakthrough were ordered back to Britain. It was during this hasty and disorganised evacuation that a large proportion of the Hurricane losses that Dowding was trying to avoid occurred. Even virtually factory-fresh Hurricanes had to be destroyed in the haste to evacuate.[7]

A relieved Dowding viewed it as a triumph of common sense. Two days later, the British launched their Arras counter-attack, which might have caused the Germans serious problems had there been even a modicum of air support.

A RUDE AWAKENING

Dowding's determination to keep his fighters out of France had nothing to do with the way the battle was progressing on the ground. Before the German offensive it was assumed the French Army was invincible. For a while in May 1940, the fate of France hung in the balance. Then, French defeat became ever more certain with each passing day. None of this influenced Dowding in any way. His stance had remained constant throughout. The danger to Britain was across the North Sea, not through France. His Fighter Command had been created to protect British cities, not Allied troops, and defending Britain had to be the priority.

With France defeated, Britain suddenly found itself facing an unexpected and very different danger. As well as a knockout blow, Britain also now faced the prospect of an invasion in its south-east corner. This was not a storyline the Air Ministry or Dowding had planned for. Dowding

"RAF Groups out of range of the Bf 109 had the same proportion of Spitfire squadrons as those within range, even though the Spitfire was the only fighter capable of taking on the German single-seater . . ."

BAE SYSTEMS

ABOVE ***A typically bustling scene at the home of Spitfire Mk I-equipped No 611* (West Lancashire)** ***Sqn. The unit operated from RAF Digby in Lincolnshire during the Battle of Britain as part of No 12 Group, responsible for the air defence of the Midlands, Norfolk and Lincolnshire. No 611 Sqn had also taken part in the operations over the beaches at Dunkirk.***

freely conceded that while his static air-defence system was ideally organised for defending the country, it was not capable of concentrating resources over a narrow invasion front.[8]

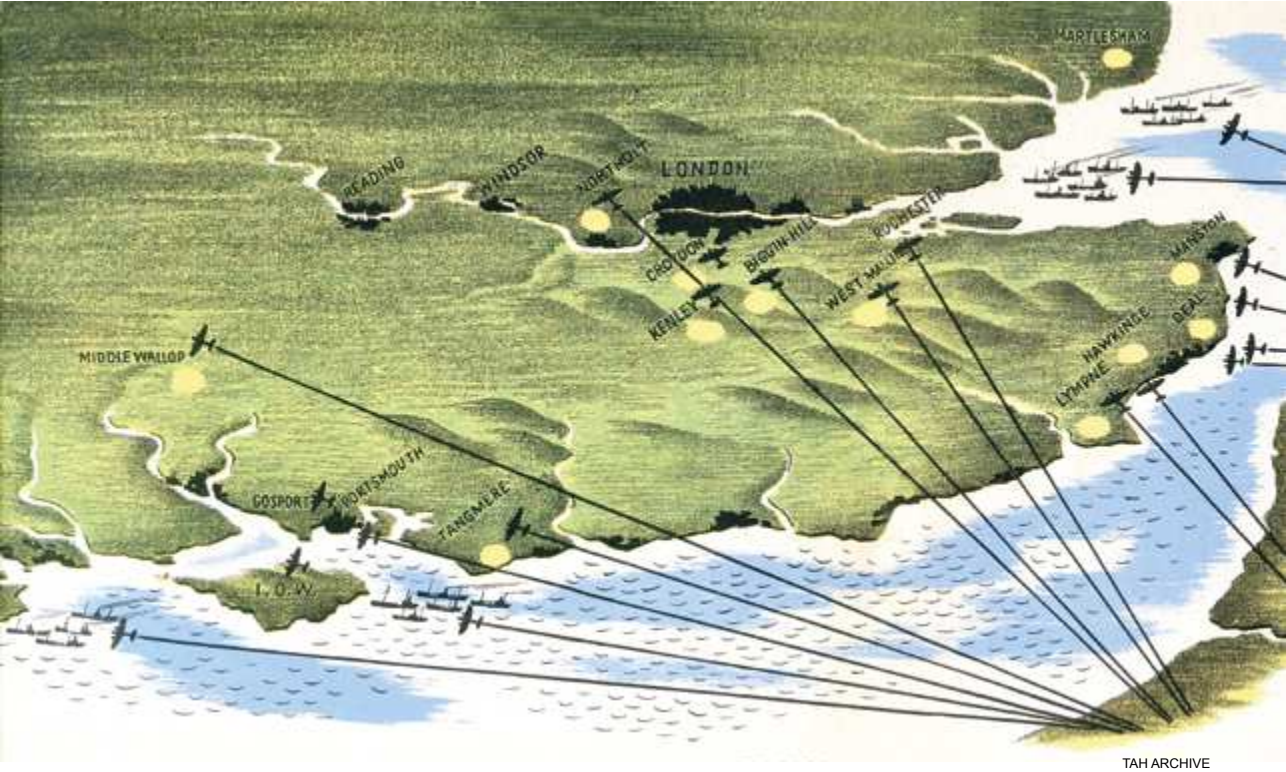
Even with the prospect of imminent invasion, the German bomber threat still dominated thinking. The Air Ministry and Lord Beaverbrook, in charge of aircraft production, were convinced that the German bomber force could wipe out the British aircraft industry at a stroke. Fighter Command could not afford to drop its guard. With the Luftwaffe established in northern France, the RAF's No 10 Group was created to extend the defensive belt along the south coast. However, Dowding explained to his commanders that in the forthcoming battle, no particular Group could expect any favouritism; the job of Fighter Command was to defend the entire country, not just one particular part of it.[9] The density of fighter defences remained broadly in line with the population they had to defend. London was the most heavily populated city and thus continued to be defended by the highest concentration of fighters. It was fortunate that the German invasion had to come in the south-east, where fighter defences were already strongest.

With the fighting focused in the south-east, the fighter resources defending the rest of the country came to be seen as a reserve, but with Dowding initially anticipating a very brief preliminary air offensive before the actual invasion, this was certainly not the intention. With half his squadrons based north of the Thames, it was a very generous reserve indeed. Spitfire squadrons continued to be spread evenly around Fighter Command. Groups out of range of the Bf 109 had the same proportion of Spitfire squadrons as those within range, even though the Spitfire was the only fighter capable of taking on the German single-seater on anything like equal terms.

Dowding's policy in the forthcoming struggle was entirely consistent with previous practice. It did not matter how furious or critical the tactical air struggle was over the hills of the Ardennes, the port of Dunkirk or the fields of Kent — leaving any part of the country exposed to a knockout blow was not a risk Dowding, the Air Staff, nor indeed Churchill, were willing to take.

DESTROY FIGHTER COMMAND!

The strategic knockout blow never came. Dowding did not realise it, but such an offensive was not even possible from airfields in Germany. The Luftwaffe never even tried to create the force of heavy bombers that might have made it possible. Hitler made excellent use of the terror the bomber generated as a diplomatic tool, but the German military never intended to bomb its enemies into submission. Germany realised it could not build its Panzer armies and simultaneously finance a strategic bomber fleet. It chose the former. It was the correct decision. Even today, the German combined-arms approach continues to be a more effective way of fighting and winning wars than the crude mass destruction the Luftwaffe was



TAH ARCHIVE

ABOVE ***Another James Gardner pastel illustration, this map shows what a small proportion of the country the Battle of Britain was fought over. By the time the Battle reached its climax in September 1940, the fighting was restricted almost entirely to the skies above Kent and London. (NB the bombers attacking the Portsmouth area actually came from the Cherbourg peninsula.)***

expected to use, or even the refined selective-bombing policy the RAF was trying to apply.

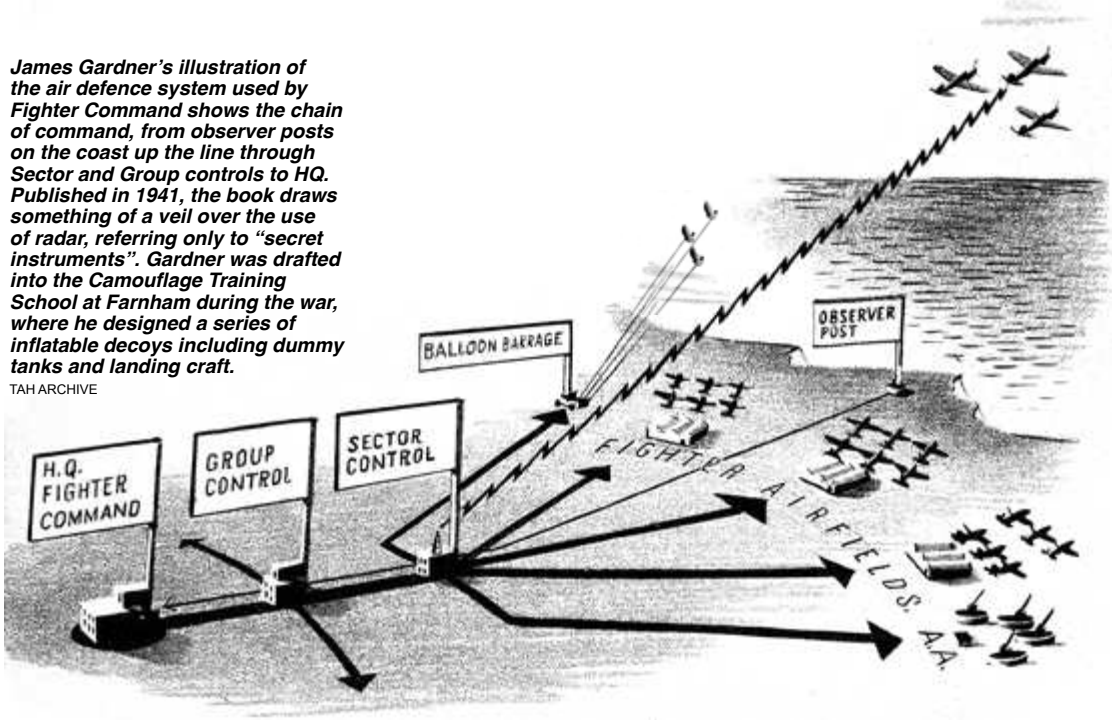
The German daylight offensive in the summer of 1940 did not have the country's cities or industrial heartlands as its target. Even from airfields in France these were beyond the capabilities of the Luftwaffe. Fighter Command, not British cities, was the target. The Germans understood that bombers flying by day had to be escorted. The battle zone would not stretch as far as German bombers could reach; it would only be fought as far as their fighter escorts could fly. That meant Kent, Surrey, Sussex and a bit of Hampshire and Essex. Britain's defences had been wrong-footed. Escorted bomber attacks over a small corner of the country were not a scenario Fighter Command had prepared for.

Dowding completed his Battle of Britain review despatch in August 1941. It was essentially an attempt to make what happened seem more like what Dowding and the Air Staff thought was going to happen. The result was some intriguing reasoning and one or two contradictions. It was written after the Blitz had demonstrated that even the full weight of the German bomber force — operating not from bases in Germany, but much closer airfields in France, Belgium and the Netherlands — was not capable of delivering the predicted knockout blow. Indeed, far from bringing about the end of civilisation, independent strategic bombing operations were having surprisingly little effect on the course of the war. This was confirmed by the Butt Report, released the same month as Dowding's despatch, which suggested that, so far, RAF bombing had effectively achieved nothing. It also followed more humiliating defeats on the ground in Greece and Crete. Once again the danger of engaging in any land battle without the best possible fighter cover had been exposed.

THE MAKING OF A MYTH?

Dowding's fighter policy had been driven by the need to counter a knockout blow. With the benefit of hindsight, this was proved to be a figment of the imagination. The aftermath of the Battle of Britain was scarcely the time to be drawing attention to a danger that had never existed. Indeed, in his August 1941 despatch, Dowding played down the one element of German operations in the summer of 1940 that was in line with Air Staff expectations. The nightly attacks on British cities that grew in intensity throughout the summer of 1940 were precisely the threat Fighter Command was created to deal with. Dowding addressed the attempts to counter these in the despatch, but was keen to emphasise that this element of the German offensive had little significance on the course of events.

How the RAF dealt with an entirely different battle, with entirely different aims, fought in an entirely different way, is perhaps the most interesting aspect of the Battle of Britain. This, however, was a discussion Dowding was keen to avoid in the summer of 1941. Dowding's assertion



James Gardner's illustration of the air defence system used by Fighter Command shows the chain of command, from observer posts on the coast up the line through Sector and Group controls to HQ. Published in 1941, the book draws something of a veil over the use of radar, referring only to "secret instruments". Gardner was drafted into the Camouflage Training School at Farnham during the war, where he designed a series of inflatable decoys including dummy tanks and landing craft. TAH ARCHIVE

that "the Battle of Britain began for me in the autumn of 1939" gives the impression of someone coolly planning ahead for a battle he knows is coming. Ironically, Dowding was referring to his struggle to keep fighters out of France. Had he had any idea that he would be facing escorted German bombers in 1940, he would have been trying to rotate as many of his fighter squadrons as possible through France to get some experience of fighter-versus-fighter combat. Instead he was turning down such suggestions.

In fact, during the Battle of Britain, there was surprisingly little direction from above on how Fighter Command should adapt its tactics. The pilots who had fought in France had at least gained some dogfighting experience, but years of training were difficult to override. During the summer of 1940 some RAF squadrons worked out for themselves that the loose pairs German fighter pilots operated in — *Rotten* — were far more effective than the tight "vic" formations their own pilots had been taught. However, little was done to disseminate this throughout the Command. Even in his 1941 despatch Dowding was only putting the use of pairs forward as a tentative suggestion for future discussion.

AN INTRIGUING CONTRADICTION

Dowding's attitude to tactical fighter support in the despatch involves a degree of "doublethink". Dowding seems anxious to demonstrate he fully appreciates the importance of air superiority over the battlefield. In the despatch he describes how crucially important air superiority had been during the Battle of France. Aircraft providing reconnaissance and bomber support for armies

Spitfire Mk I X4178 of No 41 Sqn has its Merlin III engine run up during the Battle of Britain. The unit alternated between Yorkshire and Essex during the Battle. This Spitfire served throughout the summer of 1940 but was shot down during a dogfight with a JG 51 Messerschmitt Bf 109E over Broadstairs in Kent on October 15, 1940. The 23-year-old pilot, Sgt P.D. Lloyd, was killed. TAH ARCHIVE

PHILIPPE RICCO COLLECTION

Although the French Dewoitine D.520 was inferior to its German adversary in terms of pure performance, its excellent manœuvrability and substantial firepower — a single 20mm cannon firing through the propeller hub and four wing-mounted 7·5mm machine-guns — gave the Armée de l'Air a fighter capable of holding its own against the Bf 109E. Unfortunately there were too few on strength in the spring of 1940 to make a difference to the outcome of the Battle of France.

"are driven out of the sky when the enemy fighters have a free hand".[10] He was in no doubt that the lack of effective fighter support in France, and more recently in Crete, had been a major factor in these defeats. He was absolutely right of course — but it was a complete contradiction of his policy in 1940. Yet Dowding still tried to justify the latter. This was not easy with the overriding importance of guarding against the knockout blow no longer a credible explanation. He explained in the despatch:

"I had good hopes that unescorted bomber raids on this country could be met and defeated with a very small loss in fighters; but there could be no illusions concerning the wastage which would occur if we came up against the German fighters in France."

It is scarcely a convincing argument, nor is it consistent with his newly acquired appreciation of the importance of tactical air superiority. You cannot hold fighters back from a crucial battle because they might encounter enemy fighters. Furthermore, Dowding explains, with an element of pride, how he "had succeeded generally in keeping the Spitfire squadrons out of the continental fighting". The Spitfire and arguably the French Dewoitine D.520 were the only fighters the Allies had that were capable of taking on the Bf 109E — and there were very few D.520s. Dowding was adamant that no Spitfires should go to France, only Hurricanes.

Again, his thinking in 1939 was reasonable enough. The knockout blow was the danger and he needed his best fighter where the greatest danger was. It was not possible to make that argument in 1941, however, when talk of a bomber Armageddon was somewhat fanciful and the lack of fighter cover for Allied armies was rather obvious.

AIRPOWER COMPARED

The policies adopted by the British during 1939–40 make an interesting comparison with those applied during 1917–18. The situations in the two conflicts were remarkably similar. Before and during the First World War there was equally frightening and equally inaccurate speculation about bombers laying cities to waste.[11] In 1917 there were claims that the Germans were already building a fleet of 4,000 bombers that would wipe out parts of London.[12] However, in 1917 it was also realised that with the Russian surrender and the American entry into the war, the German Army would turn all its might on to the Western Front in one last bid to break the deadlock before American reinforcements put victory beyond Germany's grasp. The German attack in March 1918 was foreseen with the same certainty as the German offensive in May 1940.

Should Britain have held its fighters back to defend London in 1918? How impressed would Britain's French allies have been by the argument that the Sopwith Camels and Royal Aircraft Factory S.E.5as of the Royal Flying Corps (RFC) should stay in Britain because their losses would be lower shooting down unescorted German Gothas rather than engaging tricky Albatros fighters over the Western Front? The German March 1918 offensive very nearly defeated the Anglo-French armies. It probably would have done had it not been for the intervention of the RFC. Had Britain withheld fighters in 1918, the

BAE SYSTEMS

ABOVE ***The RAF prided itself on its pilots' ability to fly in tight formations, like these Spitfires. German fighters encountered in France, apparently wildly weaving and jinking around, initially attracted some derision from their RAF opponents. In fact, the looser German formations made it easier to look out for prowling enemy fighters.***

German spring offensive might well have been as successful as the spring offensive in 1940.

Of course Dowding was right that radar-directing fighters to unescorted bombers was likely to be far more productive in terms of the victory/loss ratio than taking on the Bf 109 over the front line. However, sometimes wars have to be fought where the battle is taking place, not where you would like the battle to be.

Was holding back the Spitfire an error? Clearly it was. Withholding such a substantial number of an air arm's best fighter from a key battle is bound to increase significantly the chances of losing that battle. The Hurricane would inevitably struggle against the Bf 109Es it would meet in France, but it was perfectly capable of dealing with any unescorted bombers that might venture over Britain from bases in Germany. A Spitfire force well established in France before the German offensive, and Hurricanes guarding the home base, was a more logical arrangement.

Would it have made any difference if Spitfires had been deployed? It is difficult to say. So many things went wrong in the Battle of France, on the British and French sides, that correcting one of the mistakes would not necessarily have changed the course of the battle. Would we want to find out? Certainly not. History is not about refighting past battles; it is about working out what went right and what went wrong so that mistakes are not repeated. In the Battle of France the list of things that went wrong is very long, but one item that must be put on that list is the failure to make use of the Allies' best available fighter.

In truth, the failure to deploy the Spitfire to France was just one element of a far wider and more fundamental misjudgment. The damage bombers can inflict on a country, and in particular what the German bomber force was capable of, had been grossly overestimated. At the same time the value of air support on the battlefield had been vastly underestimated. It was a misjudgment that the British and French were equally guilty of. Spitfires were not sent to France for the same reason the British Army had no close air support, no armoured divisions and indeed much else required to fight a modern war. Britain had made a mistake in believing future wars would be decided by long-range bombers. All three services working together was the way war was evolving, not airpower winning wars on its own.

THE CRUCIAL FEW

Dowding got the battle over home soil he wanted, but it was nothing like the battle Fighter Command had prepared for. In the end the pilots saved the day. They were not trained for fighter-versus-fighter combat, they flew fighters that were not built with dogfighting in mind and the pilots were outnumbered to a degree they need not have been. However, they had the skill, flexibility and courage to overcome these disadvantages. The handicaps they were fighting with makes their victory all the more remarkable.

There will be different views about at what point Britain's air commanders, and indeed national leaders, should have realised the knock-out blow was not coming. Eight decades on, it is

ABOVE ***John (later Sir John) Slessor was appointed Director of Plans at the Air Ministry in December 1938 and Air Aide-de-Camp to the King in January 1939.***

a lot easier to see the British and French decisions to hold back their fighters to deal with this threat as a major misjudgment. The bomber hysteria that engulfed so many nations made it difficult to see this was a mistake at the time, but not impossible. Marshal of the Royal Air Force Sir John Slessor is more famous as a protagonist of the bomber strategy, but in April 1939, as Director of the Air Ministry's plans department, he made the following prophetic observation about the war to come:

"We might be faced in the initial stage of such a war with the spectacle of five or six hundred good short-range fighters sitting in England unable to contribute at all to the issue of the struggle in the Low Countries — a struggle on which the subsequent fate of England might depend."[13]

In 1951, with many fearing the Korean conflict sparking World War Three, Slessor found himself making the same point. British defence policy in the 1950s was essentially the same as it had been in 1940; it included holding back as many fighters as possible to defend the UK. Gloster Meteor and de Havilland Vampire jet fighter squadrons up and down the country stood ready to repel another knockout blow, this time delivered by Soviet bombers armed with atomic bombs. Nobody doubted these had the destructive powers many had feared in the 1930s; once again the threat from the air seemed far more menacing than the threat on the ground. But was the knockout blow any more likely? Why would the Soviets risk atomic retaliation? Was not the real danger the Soviet Union's tank armies, just as it had been the German Panzers in the late 1930s and 1940s? The RAF's tactical air force in Germany (still called British Air Forces of Occupation — BAFO) stood ready to help repel the Red Army. Slessor, now Chief of the Air Staff, once more saw the danger: "Fighter Command [at home] as planned is still disproportionally strong compared to BAFO, especially taking into account . . . the strong air forces building up in front of us on the continent".[14]

LESSONS LEARNED?

Had the Cold War turned hot, history might have repeated itself. Fighter Command might have stood ready for a threat that never came, as Soviet tanks, with powerful air support, rolled across Europe towards the Atlantic coast, leaving Britain relying on the English Channel once again. Unlike Hitler, Stalin had no enemy in the east to distract his attention. He might have learned from his former enemy and not have made the mistake of leaving a potentially dangerous island base unconquered.

In the spring of 1918 enough British air power was in the right place to halt the German advance. In the spring of 1940 too many RAF aircraft were in the wrong place, France was defeated and Britain was pushed to the brink of defeat. One can only speculate about what would have happened in the 1950s. Even today, Dowding's determination to prevent fighters being sent to France is still seen by some as a stroke of genius. However, a policy is not correct just because it all turned out fine in the end. In the 1950s it might not have turned out so well.

1 UK National Archives (TNA) ref AIR 8/863
2 Baughen, G., *Blueprint for Victory*, Fonthill Media, 2014, pp206–207
3 Baughen, G., *The RAF in the Battle of France and the Battle of Britain*, Fonthilll Media, 2017, pp16–21
4 TNA ref AIR 16/190, September 1939
5 TNA ref AIR 14/449, May 14, 1940
6 Baughen, G.,*The RAF in the Battle of France and the Battle of Britain*, op cit; also *The German Air Force in France and the Low Countries,* Chapter 8, Speidel, USAF Historical Studies No 152 (unpublished), pp238, 257
7 TNA ref AIR 41/22, Appendix M; also Cull, B., Lander, B., Weiss, H., *Twelve Days in May*, Grub Street, 1995, pp290, 306; Bingham, V.F., *Blitzed!,* Air Research Publications, 1990, p92
8 TNA ref AIR 16/347, July 3, 1940
9 TNA ref AIR 16/212, July 3 & 8, 1940
10 TNA ref AIR 8/863, para 190
11 Baughen, *Blueprint for Victory*, op cit, pp12–18,
12 Ibid, pp152–153 & 192–196
13 TNA ref AIR 16/119, April 6, 1939
14 TNA ref AIR 8/2596, February 27, 1951

DACRE WATSON COLLECTION x 3

ITALY'S FORGOTTEN AIRLINES

PART TWO / EXPANSION: SAM, NAA, ALI, AVIO TRASPORTI, ALA LITTORIA AND LATI

Continuing his three-part series on the development of Italy's airlines, from the early days of the pioneers to the end of the independents in the late 1950s, **MAURICE WICKSTEAD** describes the consolidation of the nation's "grandfather" airlines into an ever-diminishing cadre of government-sanctioned operators more in line with Mussolini's nationalist agenda

SIAI-Marchetti S.55 flying-boat I-AABF (c/n 97), thought to be the S.55P prototype (with deeper hulls faired into the upper surface of the wing), joined the SAM fleet in June 1928. It was used predominantly on the Rome—Cagliari service, as marked on the forward section of the port hull in this rare flying shot of a SAM S.55P. This machine was withdrawn from use in 1933.

LUIGINO CALIARO COLLECTION

IN THE LATE 1920s Italo Balbo — aviator, ardent supporter of Mussolini and Under Secretary to the *Regia Aeronautica* (Air Minister from 1929) — came up with the idea of combining all of Italy's airlines into a single entity under government control. In hock to the banks and financial institutions and unable to survive without substantial state subsidies, it was inevitable that the independent carriers would succumb to Italy's creeping nationalisation.

FOUR BECOME ONE

Balbo's idea became a reality with the formation of *Società Aerea Mediterranea* (SAM) in late March 1928, with government capital and contributions from manufacturers SIAI-Marchetti (aircraft) and Isotta-Fraschini (automobiles and aero-engines). The new enterprise was intially headed by the *Marchese* Francesco de Pinedo, one of Italy's most distinguished aviators, famous for his series of long-distance flights in the 1920s and 1930s *[See Johnny de Uphaugh's article* Lord of the Distances *in* TAH2 *— Ed.]*

The first SAM service took place on April 21, 1928, when a SIAI-Marchetti S.59 flown by Pinedo and an S.55P flown by Rigoberto Salminci with five passengers flew from Rome (Ostia) to Palermo, Sicily, via Olbia on Sardinia. Pending full integration of the four independents — *Società Italiana Servizi Aerei* (SISA), *Società Anonima Navigazione Aerea* (SANA), Transadriatica and *Aero Espresso Italiana* (AEI), covered in Part One *(TAH31)* — SAM began developing its own network. Within a year or so, it stretched to Munich and Vienna in the north; to Tripoli in Libya in the south, and east to Tirana in Albania and Salonica (Thessaloniki) in Greece, using S.55Ps and Junkers-F 13s. By 1933 Berlin and Tunis had been added to the network.

In 1929, following a series of disagreements with Balbo, de Pinedo ceded the management of SAM to Umberto Klinger, a decorated Great War pilot and latterly head of the Regia Aeronautica's main transport unit. Klinger set about putting SAM on a firm footing, and in December 1931 oversaw SAM's absorption of Transadriatica, followed by that of SISA in May 1934 and SANA a month later. Although also coming under the SAM banner, AEI continued operating under its own name for another few months. By this stage SAM's route network covered around 4,000 miles (6,400km), flown primarily with a mix of various types of SIAI-Marchetti seaplanes, Caproni and Breda landplanes and aircraft inherited from the independent carriers.

Since 1925 Italy had begun to make inroads into Albanian public and economic life and the former's influence rendered the country a *de facto* protectorate. In July 1927 the Italian government bought the shares of Adria Aero Lloyd, a subsidiary of German airline *Deutsche Luft Hansa* (DLH) through an earlier merger, which after just a year of operation was struggling to maintain regular services in Albania. Adria's ancient AEG J III aircraft were replaced with Junkers-F 13s, which served the towns of Coritza (Korçë), Valona (Vlorë) and Scutari (Shkodër) from Tirana, where a connection was made to the SAM trunk route between Rome and Salonica.

An airline that kept its relative independence

OPPOSITE PAGE, TOP ***A characteristically attractive collection of Italian airline ephemera from the early 1930s, including timetables of ALI (furthest left) and SAM (furthest right) and a stylish poster for Ala Littoria.*** **OPPOSITE PAGE, BOTTOM** ***SIAI-Marchetti S.59P I-AACO (c/n 9566) joined the SAM fleet from AEI in late 1934.*** VIA LUIGINO CALIARO

Caproni Ca.101bis I-ABCB (c/n 3252) was one of six operated by Nord Africa Aviazione (NAA) along the North African coast between Benghazi and Tripoli in Libya. The trimotors entered service with the airline in mid-December 1931, but I-ABCB is listed as having been destroyed in March 1934. The Ca.101bis was a slightly enlarged variant with more powerful engines for colonial service.

BELOW LEFT ***Aircrew and passengers pose for a photograph beside one of NAA's six Ca.101s in North Africa. Only 18 civil Ca.101s were built.*** **BELOW RIGHT** ***The cabin of the Fiat G.18V accommodated up to 18 passengers in two single rows. In addition to the passengers, a standard crew for a G.18V was two pilots and a radio operator.***

BELOW ***In 1925 Italian car and railway magnate Nicola Romeo acquired the licence to build the Fokker F.VIIB/3m trimotor; only three were built — I-AAXY, I-AAXZ and I-FERO — all of which served with ALI. The first two are seen here at a snowy Taliedo airport in Milan; I-AAXZ was lost when it crashed on Mt Basso, near Turin, in April 1936.***

LUIGINO CALIARO COLLECTION x 4

LUIGINO CALIARO COLLECTION

ABOVE ***Designed by Celestino Rosatelli specifically for ALI's Venice—Milan—Paris service, the sole Fiat APR.2, I-VEGA, first flew in 1935 and began plying its trade on the route the following year. Accommodating two pilots and 12 passengers, the APR.2 was reported to be the world's fastest airliner in regular service on its introduction.***

for several years was *Nord Africa Aviazione* (NAA), created in July 1931 at the behest of the Minister for Colonies. Its principal was experienced former SISA pilot Luigi Maria Ragazzi, and the technical director was Bruno Vellani, later to become a vital figure in the development of Italy's post-war airline Alitalia. Services for NAA got under way on December 26, 1931, with Ragazzi carrying dignitaries and mail in a Caproni Ca.101 trimotor between Benghazi, Sirte and Tripoli in Libya. With a small fleet of Ca.101s — I-ABCB, 'BCC, 'BCH, 'BCI, 'BCJ and 'BCK — the coastal network was extended eastwards to Derna, Tobruk, Mersa Matruh and Alexandria in Egypt. The airline was incorporated into Ala Littoria in August 1935, but not before it had transported some 2,800 passengers, ten tonnes of mail and 33 tonnes of baggage during the course of some 280 flights.

Another carrier that would completely escape the clutches of the state was *Avio Linee Italiane* (ALI), backed by the might of the Fiat industrial empire. Since its foundation as part of the famous car company in 1918, Fiat Aviazione had become a major constructor of aircraft and aero-engines, and entry into the airline business was a natural progression. Established in November 1926, ALI elected to concentrate primarily on international routes. On June 11, 1928, it inaugurated a Milan—Trento—Bolzano—Klagenfurt (Austria) —Munich service flown with a Romeo Ro.10 (Italian licence-built Fokker F.VIIB/3m, probably I-AAXY or 'AXZ), in conjunction with Austrian airline *Österreichische Luftverkehrs AG* (OLAG). Extension to Rome came in October and a Turin—Rome service was added in September 1929. By 1934 this had developed into separate Milan—Turin and Milan—Rome services.

Over the next decade or so, up until 1940, ALI gradually developed a substantial European network encompassing Cannes, Marseille, Munich (via Bolzano and Innsbruck, Austria, in pool with OLAG/DLH), Berlin (via Nüremburg

BELOW ***Another type used exclusively by ALI, the Fiat G.18 was designed by Giuseppe Gabrielli and made its maiden flight in March 1935. After one prototype and two production examples, the type was modified with a revised fin and rudder and more powerful Fiat A.80 engines, to become the G.18V, of which a total of six was built.***

LUIGINO CALIARO COLLECTION

Of similar configuration to the Junkers Ju 52/3m — but with the German utilitarian lines softened to provide a far more characteristically elegant Italian profile — the SIAI-Marchetti SM.73 trimotor first flew in 1934. Avio Linee Italiane's six Alfa Romeo 126 RC.10-engined examples — I-SAMO, 'SETI, 'SUTO, 'SAUL, 'SITA and 'STAR — joined the ALI fleet in early 1937.

LUIGINO CALIARO COLLECTION x 3

BELOW *The CANT Z.506 seaplane, designed by Filippo Zappata, became a stalwart of the Ala Littoria fleet, the first production batch, powered by Wright Cyclone engines, joining the fleet in 1936. This Z.506C, I-DUNA, fitted with Alfa Romeo engines, joined the fleet in September 1938 and was impressed into military service in June 1940.*

BELOW *During 1934–35 SIAI-Marchetti built three SM.74 four-engined 24-passenger landplanes for Ala Littoria — I-URBE (as seen here), I-ALPE and I-ROMA. The first two were powered by four 700 h.p. Piaggio Stella X.RC radial engines, while I-ROMA was fitted with Alfa Romeo Pegasus IIIs. All three later served with the Regia Aeronautica.*

LUIGINO CALIARO COLLECTION

ABOVE ***SIAI-Marchetti SM.71 I-EOLO was one of at least five absorbed into the Ala Littoria fleet from SAM, and served with ALSA until October 1939, when it was destroyed. The trimotor, which first flew in late 1930, was the first of SIAI-Marchetti's multi-engined landplanes and could accommodate three crew and up to ten passengers.***

and Leipzig in pool with DLH), Amsterdam (via Cologne or Rotterdam in pool with DLH/KLM), London (via Paris in pool with Air France/Imperial Airways Ltd), Belgrade/Budapest and Budapest/Warsaw/Gdynia. These services were flown with Fiat G.18Vs, SIAI-Marchetti SM.73 trimotors and a sole Douglas DC-2.

A NEW STATE CARRIER

On October 28, 1934, the 12th anniversary of the Fascist March on Rome, SAM became Ala Littoria SA (ALSA), a title alluding to lictors' bundles, a central part of the *fasces* symbol, reportedly suggested by Mussolini. Befitting its status, the airline was headquartered in a grand purpose-built headquarters at Rome's Littorio airport.

With Klinger remaining at the helm, attention was initially focused on integrating the diverse constituent companies and upgrading the nation's airport infrastructure, largely operated by private interests. The company's capital was 18m *lire*, and while state subsidisation was initially maintained at the previous rate, the creation of a single airline saved the treasury an estimated 12m lire. This government support would reduce by around 25 per cent over time owing to increased efficiencies.

As the network expanded rapidly (incorporating around 38 domestic and European points by early 1937) there was an urgent need for fleet renewal. SAM had inherited a fleet of 76 aircraft, comprising 46 seaplanes and 30 landplanes; but, by the time it was transformed into ALSA, the majority were largely obsolete and inadequate for a rapidly growing network. In August 1935, 25 examples of CANT's new three-engined Z.506 seaplane were ordered, with delivery commencing the following year, along with the first batch of SM.73s. Six Macchi MC.94s were also purchased to replace SISA's ancient CANT seaplanes on Adriatic services. Three Junkers Ju52/3ms, re-engined with more powerful Piaggio powerplants, entered service in early 1935, primarily over trans-Alpine routes to Austria and Germany, on which they could handle icing conditions better than the SM.73s.

The integration process continued throughout 1935, and was completed with the induction of NAA, AEI and agreement with the Albanian government to absorb Adria Aero Lloyd, allowing the consolidation of Adriatic services by that September. Negotiations were also concluded with Air France, DLH and KLM for continuation and extension of pool services to Frankfurt, Amsterdam, Paris and London, the latter inaugurated in July with SIAI-Marchetti's new four-engined SM.74, in pool with Air France.

THE IMPERIAL LINE

From the outset ALSA had been tasked with serving Italy's East African colonies, crucial to maintaining transport and communications links between the mainland and its satellite states, although financial considerations and the need to establish and assimilate the European network put this on the back burner for a while. However, in November 1934 First World War ace Major Carlo Francis Lombardi and Vittoria Suster (SAM's chief pilot for northern and central Europe) undertook a proving flight in SM.71 I-ALPI between Rome and Mogadishu in Italian Somaliland (now Somalia). Staging via Tobruk in Libya and Massawa in Eritrea, they covered the 3,850 miles (6,200km) in 35hr 35min, establishing a new record (albeit a briefly held one).

The Caproni Ca.308 Borea (North Wind) was originally designed by Cesare Pallavicino, chief engineer at the Bergamaschi company, which was acquired by Caproni in the 1930s. The twin-engined wooden monoplane could carry three crew and up to seven passengers. This example, I-DRIA, joined the ALSA fleet in January 1936 and was one of five used along the North African coast by the airline. It was destroyed in March 1938.

LUIGINO CALIARO COLLECTION

LUIGINO CALIARO COLLECTION

RIGHT ***The cabin of the CANT Z.506C was divided into two sections, each containing six seats (although up to 15 or 16 in total were sometimes fitted). The forward section was immediately aft of the cockpit and radio operator's station, as seen here. Note the rather elegant oxygen hoses attached to the cabin wall, for use on services over high terrain.***

The commencement of a regular service was constrained by a lack of suitable long-distance aircraft. A temporary solution was found by means of an agreement with Britain's Imperial Airways Ltd (IAL) to transport ALSA passengers from Brindisi in southern Italy to Khartoum in Sudan by flying-boat, operating as part of IAL's colonial route to South Africa. As mentioned in Part One of this series, IAL had been prevented from flying directly over Italian territory owing to suspicions of aerial espionage, and was restricted to operating from Italian coastal ports. As a result, on July 22, 1935, ALSA was able to open a stopgap service via Khartoum to Italy's colonies; the route split at Khartoum into two lines, one to Asmara and Massawa in Eritrea (via Kassala in Sudan), and the other via French Somaliland (Djibouti) to Mogadishu. Taking four days end-to-end, the service had an initial frequency of three or four per month, operated in the interim period with Fokker F.VIIB/3m trimotors and twin-engined seven-passenger Caproni Ca.308 Boreas.

With the deliveries of its new aircraft, by the end of 1935 ALSA was finally ready to fly all the way from Italy to Asmara and Mogadishu under its own steam. The first outward proving flight took place on December 19, 1935, carrying around 200,000 letters. The return flight back to Rome departed Mogadishu on New Year's Day 1936. Shortly afterwards a regular service, building to four times weekly, was opened, the Rome (Lake Bracciano)—Syracuse (Sicily)—Benghazi—Cairo sector being operated with CANT Z.506 seaplanes before the service continued on with SM.73s, flown only during daylight hours. Emphasising the prestigious new service, the title *Linea dell'Impero* (Imperial Line) was adopted.

DEEPER INTO AFRICA

Perhaps embracing Hitler's concept of "The Thousand Year Reich", Mussolini aspired to create a new Roman Empire based on dominance of the Mediterranean (which he described as *Mare Nostrum* — "Our Sea") and expansion of Italian

DACRE WATSON COLLECTION

LUIGINO CALIARO COLLECTION

ABOVE ***Designed by Rodolfo Verduzio, the Caproni Ca.133 was a development of the same company's Ca.101 and was used extensively by Ala Littoria on its East African services. The airline's services from the home country to its colonies and territories in the Horn of Africa were operated as part of the*** **Linea dell'Impero,** ***as the 1939 timetable,*** **ABOVE,** ***shows.***

territories in the Horn of Africa. An obvious target, adjacent to Italy's existing colonies, was Abyssinia (a monarchy covering what is now Ethiopia and Eritrea). Using the thinly disguised excuse of a border dispute with Italian Somaliland, Italian forces invaded on October 3, 1935. Following seven months of fighting, Addis Ababa, the capital, fell to the Italians in early May 1936. An ALSA service to Addis commenced in October 1936, following the same route as far as Asmara, before turning south to the capital via Diredawa in Ethiopia. One unusual feature of the timetable was that, apart from a 1015hr departure from Rome, the rest of the timings were just given as "morning", "afternoon" or "evening", reflecting the unpredictability of conditions and lack of mainline support en route. The one-way fare was around 6,000 lire, with much of the airline's revenue deriving from the East African sector, although passenger numbers, mainly comprising government officials, were considerably lower than on the rest of the network.

In order to maintain essential civil and military administration and ensure effective communications throughout the territory, by this point known as *Africa Orientale Italiana* (AOI — Italian East Africa), it became necessary to establish an internal air network quickly. By November 1939, 16 towns and cities, including some in French Somaliland, were being served, most at least several times each week, flown with a fleet of Caproni Ca.133 trimotors.

Another small company, *Avio Trasporti SA*, was established in 1938 to operate cargo services within East Africa with seven Caproni Ca.148s based at Assab in Eritrea. The enterprise was shortlived, however; in March 1940 it was rolled into ALSA and the operational base was switched to Asmara. The Italian occupation of Abyssinia was not without political consequences. The League of Nations imposed sanctions on Italy, which could have affected the airline's substantial reliance on foreign-manufactured aero-engines

BELOW ***The Ca.133 was itself developed into the beefier 460 h.p. Piaggio Stella VII-engined Ca.148, which also incorporated a strengthened undercarriage and a deeper fuselage. Seven were operated by Avio Trasporti SA from Assab in Eritrea, including I-POGG (c/n 4145), seen here in pristine condition in Italy before its departure to Africa.***

LUIGINO CLAIARO COLLECTION

LUIGINO CALIARO COLLECTION

ABOVE ***Designed by Mario Castoldi, the Macchi MC.100 trimotor twin-finned flying-boat was a development of the twin-engined single-finned MC.94, and joined the ALSA fleet in the spring of 1939. The three examples built — I-PACE, I-PLIO (seen here) and I-PLUS — all served with Ala Littoria, often on services to Spain and Portugal.***

to power its aircraft; more than half of its stock was from the UK, USA and Czechoslovakia. There were also difficulties with overflight rights through British-controlled Egypt and Sudan.

In the event these sanctions were somewhat half-hearted and Italy withdrew from the League in December 1937. At this stage ALSA had 84 aircraft of 12 different types and a workforce of almost 2,000, 260 of which were flight crews. All personnel were members of the *Gente dell'aria* (People of the Air) trade union and enjoyed a national work contract. Around 114,000 passengers were transported between some 60 points, domestic and international, over a network covering approximately 15,750 miles (25,350km), with nearly 400 weekly flights across the system.

NEW HORIZONS

Keen to forge links with other European right-wing leaders, late in 1936 Mussolini came to the aid of *Generalissimo* Francisco Franco in Spain's Civil War by providing military vehicles and large quantities of arms and munitions. As well as providing Italian ground troops, Mussolini sent units of the Regia Aeronautica, known as the *Aviazione Legionara,* which conducted bombing and transport missions on behalf of the Spanish Nationalists, deploying some 700 aircraft and more than 6,000 airmen and support personnel.

Italy's flag-carrier saw benefit from this new-found "friendship" by opening a service from Rome to Cadiz via Palma, Majorca. By April 1937 this had developed into a thrice-weekly run over the route Rome—Palma—Melilla—Cadiz, flown with a CANT Z.506. Early in 1938 ALSA's Spanish services were extended still further, linking Melilla with Tetuán in Spanish northern Morocco, and Malaga and Seville, from where a multi-stop connection was eventually made to Lisbon in Portugal, all flown with SM.73s. Barcelona was added in 1939, latterly employing the new 26-passenger Macchi MC.100 trimotor flying-boat. With the revival of the Iberia name in 1937, ALSA took a 12·5 per cent stake in Spain's national carrier, providing three Ju 52/3ms through DLH in lieu of capital to get the airline off the ground.

New routes in Europe continued to be opened through 1937 and 1938. Prague was connected with Venice via Klagenfurt and Bratislava in Czechoslovakia, flown in pool with *Československé státní aerolinie* (Czechoslovakian State Airlines — ČSA) and a service between Rome, Belgrade in Yugoslavia and Bucharest in Romania was also instituted. Further afield, the Athens seaplane service was continued through to Haifa in British-mandated Palestine in May 1937, and on to Baghdad and Basra in Iraq in the spring of 1939.

A significant improvement to East African colonial and other long-distance routes came about in mid-1938 with the arrival of the SIAI-

Ala Littoria's identity was bound inextricably with the Fascist ideology of Mussolini, its emblem incorporating a swallow, representing flight, superimposed on a* fasces *symbol, the ubiquitous icon of Italian Fascism, comprising a bundle of birch rods (representing strength) bound together with an axe (representing the rule of law).

VIA ROB MULDER

ABOVE ***Designed as a successor to the SM.73, the SIAI-Marchetti SM.75 made its first flight in November 1937 and was the largest of the manufacturer's trimotor transports. The type was the first of the company's civil transports to be fitted with a retractable undercarriage and joined the ALSA fleet in 1938 to serve on long-distance routes.***

Marchetti SM.75 trimotor. Capable of carrying 17 passengers over a distance of 1,070 miles (1,720km), the new aircraft permitted the Rome—Addis Ababa service to be flown without change of aircraft and eliminated two intermediate stops.

ACROSS THE SOUTH ATLANTIC

The Italian diaspora between 1880 and the 1920s saw the migration of several million people from the home country to Argentina and Brazil. The attraction of maintaining good relations and communications with those nations and its expatriate citizens, as well as challenging the dominance of Air France and DLH over South American routes, led Italy towards creating an air link across the South Atlantic. But Mussolini's adventures in East Africa and Spain had drained resources, delaying any serious efforts in that direction until the late 1930s.

Although there had been several flights made between Italy, Brazil and Argentina, most notably by de Pinedo in 1927 and Balbo's formation air cruise to Rio de Janeiro in January 1931, it was not until December 28, 1937, that any earnest moves were made. On that date CANT Z.506B I-LAMA, commanded by test pilot Mario Stoppani, made a record 4,350-mile (7,000km) crossing between Cadiz and Caravelas in Brazil in 26hr 25min. Unfortunately, the aircraft crashed on the return trip, killing all aboard except Stoppani.

Concerted efforts to prove the route began on January 24, 1938, when three SIAI-Marchetti SM.79 trimotors — I-BISE, 'BRUN and 'MISE — left Rome's Guidonia military airfield for Dakar in French West Africa (now the capital of Senegal) and thence Rio de Janeiro, which was reached in 13hr 35min, a record for the 3,325-mile (5,350km) flight. Their crews, one of which included Mussolini's younger son, Bruno, were all officers of the *12° Stormo Bombardamento, "Sorci Verde"* (12th Bomb Wing, "Green Mice"), which had previously achieved fame by winning the 1937 Istres—Damascus—Paris race in the same type of aircraft. It had been planned to continue the flight on to Argentina, but unlike in Brazil, a distinct anti-fascist sentiment prevailed there and it was deemed unwise to proceed. Instead, as a gesture of goodwill, the three SM.79s were donated to the Brazilian Army Air Service and the Italian crews returned home by sea to an enthusiastic reception.

In March 1938 ALSA despatched CANT Z.506C I-ALAL on a survey to Buenos Aires via Bathurst (now Banjul) in The Gambia and Bahia, Brazil. On board was Umberto Klinger, who inspected all the intended stops to be used on a planned Italian mail service. Mussolini approved the project two months later, leading to the creation of *Direzione Centrale Linee Atlantiche*. However, bitter differences soon arose between ALSA's management and the men of the *Sorci Verde*, whom Mussolini favoured to lead the new divison, regarding the choice of equipment — seaplanes or landplanes. The matter was ultimately resolved in favour of the latter and, starting in late 1938, deliveries of the ten-passenger SIAI-Marchetti SM.83 trimotor commenced.

TAH ARCHIVE x 2

FAR LEFT ***Attilio Biseo was a highly distinguished aviator who had participated in several significant long-distance flights as one of the*** **Sorci Verde** ***when he was appointed one of the two director-generals of LATI in 1939 . . .***

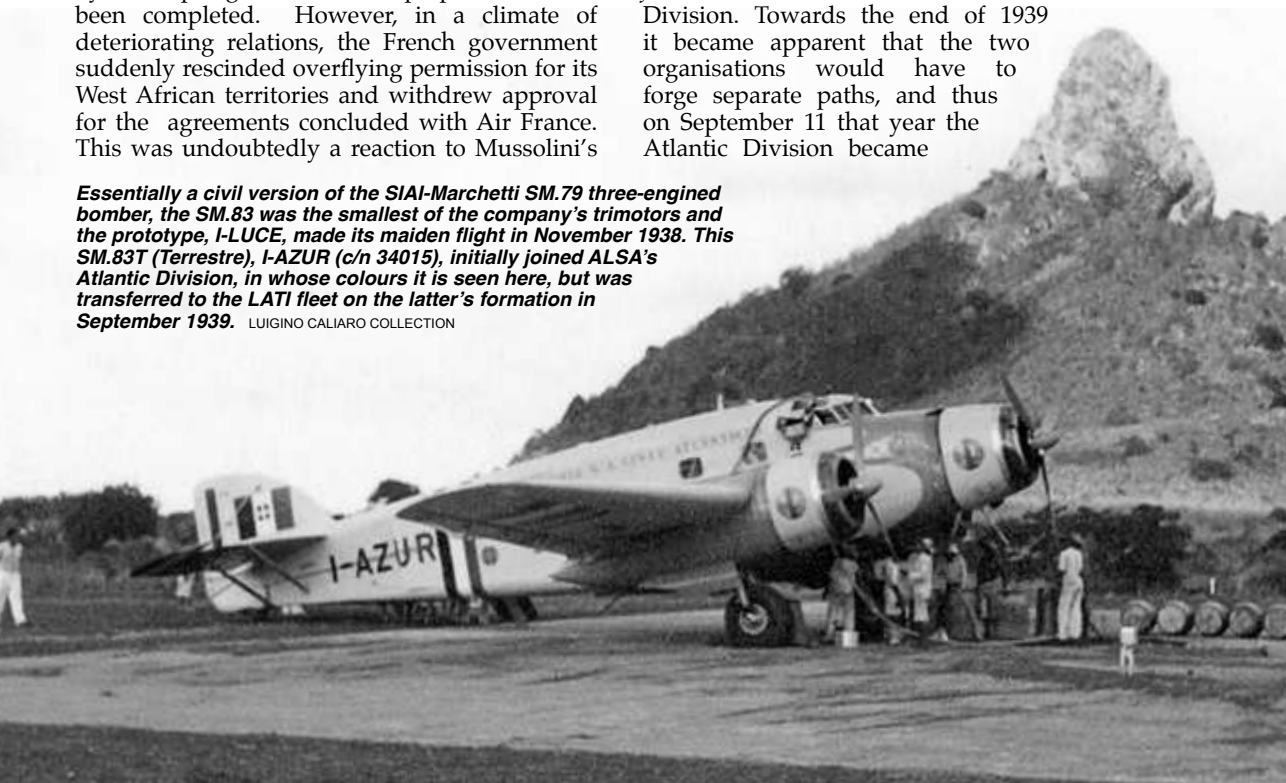
LEFT ***. . . along with Bruno Mussolini — the Italian leader's third son with his wife Rachele. A highly regarded aviator, Bruno was killed in the crash of the Piaggio P.108 four-engined bomber prototype during a test flight in August 1941.***

Developed from the SM.79 bomber and supplied in two versions, T (*Terrestre*) and A (*Atlantiche*) respectively for overland and oceanic sectors, an SM.83 undertook a route-proving flight from Rome to Rio de Janeiro in February 1939, flown by Attilio Biseo and Valentino Pivetti, formerly of Transadriatica. It suffered numerous setbacks en route, however, mainly owing to the overheating of the spark-plugs. The following month tropical trials to Tripoli and Asmara were undertaken in another SM.83 with a crew headed by Bruno Mussolini.

A year was spent establishing bases and infrastructure over the route that ran Seville/Malaga—Mellilla—Casablanca (Morocco)—Dakar—Fernando de Noronha archipelago—Natal (Brazil)—Rio de Janeiro. Operating agreements were concluded with Air France for transit through French-administered territories, and by the spring of 1939 all preparations had been completed. However, in a climate of deteriorating relations, the French government suddenly rescinded overflying permission for its West African territories and withdrew approval for the agreements concluded with Air France. This was undoubtedly a reaction to Mussolini's alliance with Germany and his aggressive stance over Corsica, Tunis, the port of Djibouti and the Suez Canal in Egypt, all of which were within France's sphere of influence. This setback delayed the projected start-up by six months, as it was necessary to adopt a completely new route staging entirely through neutral territory, routing via Villa Cisneros in Spanish Sahara (now Dakhla, Western Sahara) and Ilha do Sal in the Cape Verde islands. At the latter, a complete airfield had to be hacked out of barren rock, with all supplies and specialist workers brought in by sea. Two ships were also stationed in the South Atlantic as floating wireless and weather stations.

THE BIRTH OF LATI

As time went on, irreconcilable tensions grew between the management of ALSA, which was funding the project unsupported, and the *de facto* Green Mice leaders of the Atlantic Division. Towards the end of 1939 it became apparent that the two organisations would have to forge separate paths, and thus on September 11 that year the Atlantic Division became



Essentially a civil version of the SIAI-Marchetti SM.79 three-engined bomber, the SM.83 was the smallest of the company's trimotors and the prototype, I-LUCE, made its maiden flight in November 1938. This SM.83T (Terrestre), I-AZUR (c/n 34015), initially joined ALSA's Atlantic Division, in whose colours it is seen here, but was transferred to the LATI fleet on the latter's formation in September 1939. LUIGINO CALIARO COLLECTION

MAP BY MAGGIE NELSON

Linee Aeree Trancontinentali Italiane (LATI). A fixed grant of 1m lire for five years was awarded, in addition to the usual subsidy per kilometer flown. Its president was Gen Aurelio Liotta, latterly commander of the Italian East African Air Force, while Bruno Mussolini and Attilio Biseo, both accomplished long-distance military pilots, were appointed as joint director-generals. Biseo, a decorated veteran of Balbo's aerial cruises and co-commander of the Green Mice, survived the Second World War to become a director of Itavia, a major Italian domestic carrier during 1960–80.

Following two experimental flights to Ilha do Sal in early October 1939, LATI's first timetable was issued, giving details of a weekly round trip to Villa Cisneros, taking two days in each direction. The route was divided into three sections:

- European: Rome (Guidonia) to Ilha do Sal via Villa Cisneros;
- Atlantic: Ilha do Sal to Recife (Brazil);
- South American: Recife to Rio via Bahia.

Each section was allocated three or four aircraft plus crews. With all the necessary elements in place, the inaugural transoceanic flight, carrying 500kg (1,100lb) of mail, departed Guidonia on December 21, 1939, arriving in Rio de Janeiro three days later. The simultaneous first flight in the opposite direction unfortunately came to grief when I-ARPA, out of Villa Cisneros, crashed into a mountain in Morocco during a storm with the loss of seven souls, including three journalists.

While the line was primarily intended for the carriage of mail, the SM.83's 700kg (1,540lb) payload being a limiting factor, revenue passengers were also carried. At the beginning of January 1940 the eastbound service transported seven passengers over various sections of the route. It has been reported that several escaped members of the German battleship *Graf Spee's* interned crew later returned to Germany via LATI flights. On average each trip took around 28hr flying time end-to-end over the course of two-and-a-half days, as opposed to an 18-day journey by sea. During the first quarter of operations, a total of 32 flights uplifted 38 passengers and almost 10,500kg (23,200lb) of mail and freight, mainly comprising pharmaceuticals and precious stones.

In an era peopled with colourful characters, one notable with a LATI connection was the financial fraudster Carlo Ponzi of "Ponzi scheme" fame. Fresh from a prison spell in North America, he became the airline's commercial manager in South America, his appointment having been secured through his cousin, Attilio Biseo.

NEXT TIME The series concludes with the redeployment of Italy's airlines after the outbreak of war, the peacetime aftermath and the ultimate end of the road for Italy's independent carriers

ACKNOWLEDGMENTS *The Editor would like to thank Lennart Andersson, Luigino Caliaro, Rob Mulder (www.europeanairlines.no) and Capt Dacre Watson for their invaluable assistance with the preparation of this feature*

Shorts:

THE PERENNIAL THORN

In his latest article on the political aspects of some of the most significant episodes in the evolution of Britain's post-war aircraft industry, **Prof KEITH HAYWARD FRAeS** turns his attention to a company that posed a particularly awkward problem for several UK governments owing to its unique ownership structure and politically sensitive geographical location

SHORT BROTHERS, often abbreviated just to Shorts, was a thorny problem for successive British governments. As a uniquely state-owned aircraft manufacturer from 1943 — and later located in Northern Ireland, a politically sensitive part of the UK — Shorts faced a problematic future that could not be left to the "invisible hand" of market forces. This kept the company out of both the rationalisation of the 1960s and later, nationalisation in the 1970s. The political context of Shorts was acutely underlined by the effects of the sectarian "Troubles" of the late 1960s, and, despite wanting to disengage from the company, the British government was again constrained by uniquely Northern Irish issues.

HISTORY OF AN ANOMALY

Based at Rochester in Kent, Shorts was nationalised as an emergency measure in 1943. The company's connection with Belfast dates from 1936, when it became co-owner — with shipyard Harland & Wolff — of a shadow factory, Short & Harland Ltd, sponsored by the Air Ministry, before moving entirely to Belfast in 1948.

The post-1945 environment was not kind to Shorts. Its flying-boat expertise was obsolete and its comparatively conventional design offering for the "V-bomber" specification — the Sperrin — was quickly superseded by Vickers' Valiant. The company's single-engined carrier-based Seamew anti-submarine aircraft was not a success either. One bright spot, however, was the development of a capability in electronic technology that would eventually provide an *entrée* into work on guided weapons. Increasingly, Shorts would come to depend on sub-contracting to mainland companies and its political salience as a major employer in Northern Ireland.

Shorts was associated with several important post-1945 non-company programmes, including the English Electric Canberra and the de Havilland Comet. Shorts' most important civil contract, however, was for Bristol Britannia production work. The relationship with Bristol was underlined in 1954 when the latter acquired

BELOW ***Two Short Sperrins were built to Air Ministry Specification B.14/46 for a long-range jet-powered bomber. The first, VX158, made its maiden flight on August 10, 1951, from Aldergrove in Northern Ireland. The second, VX161, seen here at Farnborough in July 1955, made its first flight at the same location on August 12, 1952.*** MIKE HOOKS

MIKE HOOKS

ABOVE ***Shorts designed and built two prototypes — XG900 and XG905 — of the S.C.1 experimental jet-powered vertical take-off and landing (VTOL) aircraft, fitted with four vertical-lift engines and one horizontally mounted for conventional flight. Both had completed transitional flights from vertical to horizontal flight by the end of 1960.***

a 15 per cent share of Shorts in support of the Britannia contract. When the government began to urge rationalisation on the industry in the late 1950s, Shorts and Bristol began to consider a full merger. Talks continued until 1959, when the government intervened to block such a move.

The Ministry of Supply (MoS — to become the Ministry of Aviation from October 1959) had realised that a merger would effectively turn the government into a risk-sharing partner on the Britannia, which was already in some difficulty and attracting political criticism. The MoS felt that Bristol was perhaps not the best-placed company to support Shorts and employment in the Province. The Ministry's assessment of Shorts' overall position in late 1958 was bleak. There was little prospect of work after the Britannia — a lot depended on developing a new military transport, further Canberra sub-contracts from English Electric and guided-weapons work.[1]

Shorts' problems were intensified when it was dropped from participating in what became the British Aircraft Corporation's TSR.2 strike aircraft. The company had been partnered with English Electric to build a V/STOL lift platform based on technology it had developed for its own S.C.1, but the Air Ministry preferred a Vickers/English Electric team. The government covered Shorts' immediate financial problems with a £74m loan from the Northern Ireland administration,[2] but its future remained problematic. The MoS predicted that, in the best possible case, 8,500 employees would be cut to 2,000. Despite the failure of the joint programme with English Electric, a link with a mainland company remained desirable, associating Shorts with a larger and more diversified company that could maintain employment in Northern Ireland.[3]

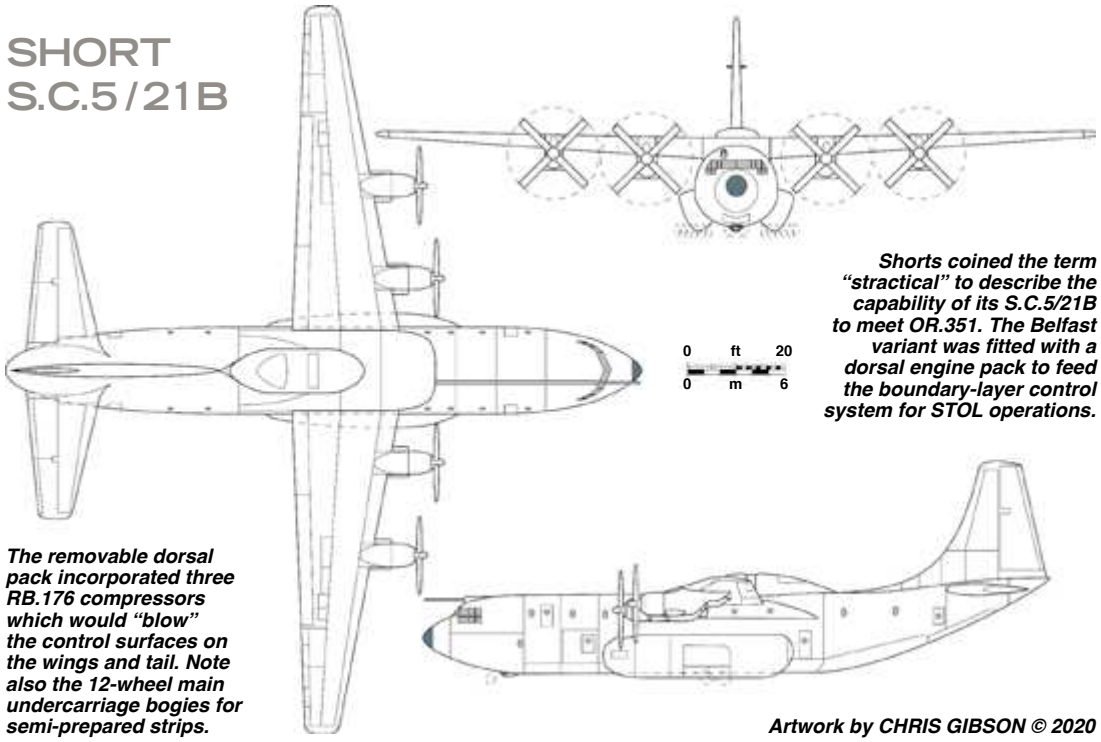
THE BRITANNIC / BELFAST

The Short Belfast military transport represented perhaps the company's biggest element of government support. A four-engined turboprop, the Belfast became the largest British-designed transport ever to enter service with the RAF. Shorts had proposed the original "Britannic" design in 1957 to meet a long-range large freighter requirement (the Handley Page Hastings/Blackburn Beverley replacement) which was accepted as the Belfast in 1959.

A Handley Page freighter proposal was rejected, as it would "reverse the policy of progressive rationalisation" of the aircraft industry. Moreover, Handley Page had no "long-term future except in association with some other company". *[See the author's* Decline & Fall *in* TAH30 *— Ed.]* Shorts, however, was an exception, as the Prime Minister, Harold Macmillan, informed the Cabinet:

"[It is] of direct concern to us not merely because we own the company, but also because it provides one of the main sources of employment in Northern Ireland. To award the contract to Shorts would not merely postpone disastrous redundancy; it would also offer to Shorts a chance of surviving and possibly playing a significant part in the production of further aircraft for the expanding freighter market."[4]

Despite its advanced avionics — it was the



Shorts coined the term "stractical" to describe the capability of its S.C.5/21B to meet OR.351. The Belfast variant was fitted with a dorsal engine pack to feed the boundary-layer control system for STOL operations.

The removable dorsal pack incorporated three RB.176 compressors which would "blow" the control surfaces on the wings and tail. Note also the 12-wheel main undercarriage bogies for semi-prepared strips.

Artwork by CHRIS GIBSON © 2020

first aircraft to be designed from the outset to be equipped with full "blind-landing" automatic landing system — the Belfast was not a success (it suffered from a serious drag problem), and a civil version had no orders. Company losses on production were likely to exceed £15m. The Northern Irish government agreed to provide a £5m loan, but this would be insufficient to complete the order. As a result, the company had an "immediate cash problem, quite apart from considerations of its long-term-viability".[5] Shorts' future seemed to depend on the outcome of the RAF's Operational Requirement (OR) 351 for a STOL (possibly V/STOL) military transport.

THE "SPECIAL PROBLEM"

The future of Shorts was an increasingly troublesome issue. In December 1958 Minister of Supply Aubrey Jones told the Cabinet that Shorts had been identified as one of four companies faced with "a large-scale contraction, and in some cases, possible collapse". Shorts' public ownership and role in Northern Ireland's economy represented "a particularly difficult problem".[6] The future of Shorts was frequently mentioned during the 1959 industry/ministerial discussions on rationalisation (Duncan Sandys' so-called "marriage bureau"). Sandys, the first Minister of Aviation, reluctantly accepted that Shorts represented a "special problem".[7]

With the formation of Hawker Siddeley Aviation (HSA) and the British Aircraft Corporation (BAC) in 1960, the MoA took another look at the option of putting Shorts into one or other of the new "supergroups". Neither option was attractive and its future was uncertain. As a June 1960 MoA memorandum notes: "From the point of view of the structure of the aircraft industry, Shorts is something of an embarrassment. It is geographically isolated from the rest of the industry; it has a poor quality of workforce, and a history of labour problems and high production costs. The continuation of the company as an independent concern is therefore in conflict with the technical and economic considerations underlying the policy of rationalisation".[8]

Public ownership was a potential showstopper; if one of the new groups absorbed Shorts, the government might have to take a similar holding in the other to prevent a conflict of interest. Nor could it abandon Shorts to the commercially driven decisions of an "English" company. Ultimately, its special place in Northern Ireland's economy ruled out an "early abolition". In the event, with a promising small freighter design and a guided-weapons project in the offing, the MoA decided that there was "nothing to be lost by waiting a while".[9]

Throughout the early 1960s the government continued to bolster work at Belfast. It accepted that "to pay a subsidy for a limited period to maintain employment in a development district would not be an innovation in the aircraft industry. The government [has] gone out of [its] way to give special help to Shorts of Belfast, whose production costs are significantly above those of [its] Great Britain [sic] competitors". Support had included an increase in the cost of sub-contract work on the Vickers VC10 contract with BOAC, and the government agreed to

MIKE HOOKS

ABOVE ***The first Belfast C Mk 1, XR362, made the type's maiden flight at Sydenham (now George Best Belfast City Airport) on January 5, 1964. Only ten were built (the type suffered from suction-drag on the tail and rear fuselage), all of which entered service with the RAF. Named*** **Samson** ***in RAF service, XR362 is seen here landing in July 1969.***

provide the firm with "considerable funds" to enable completion of work on the Belfast freighter and Seacat missile. Assurances were also given that the government would seek to try to deploy "all practical steps to ensure Shorts' future as a balanced aircraft design and production unit".[10]

A TRADING-PARK FUTURE?

The MoA's Micawber-like sentiments of 1960 (i.e. "something will turn up") became increasingly difficult to sustain. A major blow came early in 1963 when Shorts lost the OR.351 contract to HSA's AW.681 on technical and cost grounds. Shorts' offer was based on the S.C.5/21B research vehicle, which although offering a cheaper development programme, had higher production costs, was too slow and lacked development potential — a vital consideration for an aircraft to be in service well into the 1980s. Sub-contracting to Shorts some of the AW.681 work might help, but this would be costly, and the Ministry of Defence (MoD) felt that it was open to question "whether the extra cost should be borne by the defence budget".[11]

Shorts had held out great hopes to win OR.351, and the decision threatened to break up the Belfast design team. The government was warned that it would inevitably have a negative impact on employment in Northern Ireland, an area with the highest and most persistent unemployment in the UK. It was vital that "a substantial part of the work would be likely to go to Shorts", a proposal that was eventually accepted.[12] But the Ministers of Defence and Aviation remained unconvinced that Shorts had a long-term future as a design and production centre. The government's policy decision of 1960 had focused all major contracts on the two big groups, and the design team at Belfast was "too small, too inexperienced, and cannot be compared with the design resources of the main groups".[13]

In October 1962 the Cabinet decided that Shorts would receive help. It agreed to fund completion of the Belfast and Seacat contracts, at a cost of £10m, but the company's long-term future remained in question. Further RAF orders for the Belfast would be "an expensive way of reducing unemployment in Northern Ireland . . . in modern conditions the competitive disadvantages suffered by Northern Ireland were most evident in the aircraft industry, and these disadvantages would become more acute if the UK became part of the Common Market [European Economic Community — EEC]. This point should be kept in mind in examining whether the firm's premises could in the long run be used for production of something other than aircraft".[14]

The Cabinet soon had a suggestion for alternative use of the Shorts facilities. Writing to the Cabinet in February 1963, Chief Secretary to the Treasury John Boyd-Carpenter argued that:

"This company belongs to neither of the two main aircraft groups, which are our 'preferred instruments' for government aviation orders. It does not form a viable unit within the current shape of the British aircraft industry. Thus, to maintain employment at Shorts at anything like its present level, it will be necessary to distort the pattern of defence production, and place unacceptable additional burdens on the defence

MIKE HOOKS

ABOVE ***The prototype S.C.7 Skyvan, G-ASCN, seen here at the SBAC show at Farnborough in September 1964, was initially fitted with Continental piston engines for its first flight on January 17, 1963, but was re-engined four months later with Turboméca Astazou turboprops and rebranded the Turbo Skyvan. Note the original blunt nose.***

budget. This approach to the problem does not seem to me to be in the long-term interests of the company, workpeople or the Northern Ireland economy, and will give rise to continual friction."

The answer was not to push orders and other business in its direction, as governments had done in previous years: "This will not in the long run improve the position of the company, and it will leave an unduly large slice of the Northern Ireland economy dependent on a single firm with dubious prospects in an uncertain field". The best strategy was to take a bold approach to the problem. There was time before any rundown in current activity might lead to unemployment, and action taken now would anticipate the rundown and ameliorate its impact.[15] Boyd-Carpenter's prospective solution was indeed radical:

"I think that the most satisfactory means of providing new employment for the Shorts workers would be to develop the Shorts site as a trading estate. This would need very substantial assistance from public funds, to which I am in principle prepared to agree. And that Shorts should in due course cease to manufacture aircraft (the firm might stay in business in a small way as an engineering concern with perhaps some interest in missiles)."[16]

THE SKYVAN

Boyd-Carpenter's proposals were strongly opposed by Henry Brooke, the Home Secretary, who felt that sponsoring a trading estate would not only be expensive but would also imply the government accepting some of the commercial risk. More important, it would be no substitute for the quality of employment offered by Shorts.[17]

Ultimately, something did turn up, as Shorts began to put the S.C.7 Skyvan into production. The original Skyvan was based on the Miles Aerovan/Hurel-Dubois Caravan design acquired by Shorts in 1958. Having appraised this proposal, Shorts came up with its own concept for a simple twin-engined utility aircraft, which flew for the first time on January 17, 1963. Shorts still needed help to finish development, however.

In February 1964 the Cabinet discussed the possibility of aid; support for the Skyvan would be a way of improving conditions, even if the firm could not expect "a long-term future as designers of aircraft and guided weapons". It was a risky enterprise and the company might not sell enough to break even. However, the "advantages to be gained by implementing this project would outweigh the risk that some part of the further investment needed to complete the programme might have to be written off". Shorts was confident that it could find the £1·6m needed to finance the work from the £10m that had been advanced to complete the Belfast and Seacat. The government of Northern Ireland also agreed to assume a 25 per cent share of the liability arising from the commitment.[18]

The Treasury, arguing that both the aircraft industry and Northern Ireland had already received a generous level of support, opposed the decision. It was also sceptical that support for the Skyvan would enable Shorts to retain its design staff. Officials were concerned that this would not necessarily be the last call on public funds from Shorts. Claims that the aircraft would sell more than 150 units seemed "very over-optimistic". The Treasury also noted that 40 per cent of the costs were for the French-built Turboméca Astazou engines, which "would of course involve

VIA CHRIS GIBSON

LEFT ***In the 1950s Shorts turned part of its attention to the development of guided weapons. Making its public debut at the 1959 SBAC show at Farnborough, the Seacat was a short-range surface-to-air missile developed to replace the trusty but tired batteries of Bofors 40mm guns aboard warships. It entered service in 1962 and became the first operational guided missile to be fired by a Royal Navy warship.***

BELOW ***By the time of the 1968 SBAC show at Farnborough that September, problems with the Skyvan's Astazou engines in "hot and high" conditions had led to the fitting of American Garrett AiResearch TP331 turboprops on production aircraft instead, these being Skyvan Series 3s. Seen here is Series 3 N4917 of Wien Consolidated Airlines, one of five Skyvans at the '68 show.***

support for the French aircraft industry and be at the cost of our balance of payments".[19]

Brooke countered with the employment card, pointing to a further decline in jobs in the Province. The Cabinet agreed to the proposal, with the caveat that "there could be no assurance that further work for Messrs Shorts, beyond the Skyvan project and the possible order for helicopters, could be provided".[20]

TROUBLES 1970–74

With the launch of the Skyvan and the growth of its successful missile business, Shorts' future looked better by the end of the 1960s than at any time since 1943. The Conservative government elected in 1970 felt that the time was now ripe to end, or at least reduce, the company's anomalous status as a largely publicly-owned enterprise. Plans were in train to recapitalise the company and to require the Board to act more in keeping with a commercial company, with government distancing itself from its affairs and becoming only a "lender of last resort". The government would not "direct work to Shorts" and it "had to survive on its own ability . . . no money beyond that presently available would be available. This would mean a gradual running-down of the company". This could imply eventual insolvency if Shorts did not prosper, and "that it may be no longer possible to carry on".[21] Matters were not helped by the Rolls-Royce bankruptcy *[to be covered by the author in a forthcoming article — Ed.]* and a threat to a substantial contract to build nacelles for the RB.211 engine.

This bald statement of intent was swiftly stymied by the deepening political crisis in Northern Ireland. Although resolution of the Rolls-Royce crisis eased the immediate business outlook for Shorts, the increasingly violent turn of events in Belfast and throughout the Province

MIKE HOOKS

MIKE HOOKS

ABOVE ***The S.D.3-30 (later rebranded Shorts 330) was a larger development of the Skyvan, the prototype, G-BSBH, making the type's first flight from Sydenham on August 22, 1974. Powered by a pair of Pratt & Whitney Canada PT-6A turboprops driving five-bladed Hartzell propellers, the type was later acquired by the USAF as the C-23 Sherpa.***

was casting doubts on future investment. The Ministry of Aviation Supply (MoAS — the MoA had become the Ministry of Technology in 1967, which in turn became the short-lived MoAS in 1970, before military procurement was overseen by the Ministry of Defence from 1971) identified several options: to sell the company; deny it further support and precipitate collapse; or keep the company afloat with loans as necessary. The first was impracticable; the second politically and financially undesirable; and while the third was possible, it prevented any disengagement. The MoAS in London reluctantly advised that the latter was the least bad solution.[22]

The key question was the impact on employment in the Province, and implications for an already difficult situation. As one Treasury official observed, perhaps invoking the wrong set of paramilitaries given the employment profile then applicable to Shorts, "any large-scale dismissals would have a very serious political consequence. There would be that many more men available for the IRA!"[23] The Treasury now conceded that in light of the political situation, it was "no longer sensible to pretend that the government would let Shorts collapse". The answer was perhaps to adopt the Rolls-Royce 1971 solution — nationalisation — but allowing management a degree of autonomy.[24] The company could also benefit from measures designed to underpin the Northern Irish economy in general.

THE S.D.3-30 & FOREIGN OWNERSHIP

More direct support for Shorts was also on the table. This entailed speculative production of the Skyvan, developing a larger version and bringing forward orders for guided weapons. But who was to pay for this? MoAS — by now part of the Department of Trade & Industry (DTI) — was unhappy to include the Skyvan and "launch aid" (subsidisation of development for a future share of profits) for the larger version, designated S.D.3-30, and the MoD was strapped for cash in the current budgetary round. An alternative was to include the civil programmes in the Northern Ireland budget on employment grounds. This was opposed initially by both the Northern Ireland Office in London and by the Provincial government. But as MoAS/DTI argued, the S.D.3-30 could not be justified on "aerospace grounds"; its market review suggested that while break-even was possible, the project would not pay back the £8·25m needed for full development. It was also noted that the situation "cannot be allowed to drift indefinitely". Referring to a "plethora of consultants' reports, only in a much more favourable context than the present one, and with a considerable act of faith, have these been able to foresee viable commercial future for Shorts".[25]

By 1972 the Cabinet was reconciled to the need for support on political grounds, and had effectively abandoned hope in the short term to disengage from the company. As a July 1972 Paper to Cabinet from MoAS/DTI put it:

"In 1971 we had in mind a capital reconstruction combined with a statement that the company would in future operate on a commercial basis, and that the government no longer stood behind its debts. To proceed on this basis now would involve an unacceptable risk that a new crisis would befall the company in two or three years. Moreover, it might be seen in NI as an abdication from any future responsibility for the company."

It was decided to expedite extension-of-interest

1 The UK National Archives (TNA) ref AVIA 63/140, November 1958
2 Ibid
3 Ibid
4 *Strategic Air Freighters*, Memorandum by the Prime Minister (PM), February 6, 1959, TNA ref CAB 129/96/16
5 *The Future of Messrs Short Brothers & Harland*, Memorandum from Minister of Defence and Minister of Aviation, October 2, 1962, TNA ref CAB/129/110/44
6 *The Aircraft Industry*, Memorandum by the Minister of Supply, December 18, 1958, TNA ref CAB/129/85/57
7 TNA ref AVIA 63/135, December 16 and 22, 1959, January 13, 1960
8 TNA ref AVIA 63/140, Ministry of Aviation, Note on Shorts, June 2, 1960. Aircraft manufacturing was especially valued as a source of high-value employment
9 Ibid
10 A Note by the Cabinet Secretary, September 23, 1963, TNA ref CAB/129/114
11 Ibid. The AW.681 was cancelled in 1965 by the Labour government
12 *Messrs Short Brothers & Harland*, Memorandum from the Home Secretary, February 25, 1963, TNA ref CAB/129/28
13 *The Future of Messrs Short Brothers & Harland*, op cit
14 Cabinet Minutes, October 4, 1962, CAB/36/58
15 *The Future of Shorts of Belfast*, Memorandum by the Chief Secretary to the Treasury and Paymaster General, February 19, 1963, TNA ref CAB/129/112
16 Ibid
17 *Messrs Short Brothers & Harland*, op cit
18 Cabinet Minutes, February 20, 1964, TNA ref CAB128/38/27
19 *Short Brothers & Harland and the Skyvan Aircraft*, Memorandum to the Cabinet by the Chief Secretary to the Treasury, February 14, 1964, TNA ref CAB/129/116/46
20 Cabinet Minutes, February 20, 1964, TNA ref CAB128/38/27
21 Notes of meeting of Shorts Board (with government directors), September 29, 1971, TNA ref T225/3780
22 Ministry of Aviation Supply (MoAS) Memorandum to Minister for Aviation Supply, October 5, 1971, TNA ref T225/378
23 Treasury Note, October 26, 1971, TNA ref T225/378; it would be some years before the company would introduce active anti-discriminatory employment practices
24 Treasury note, October 27, 1971, TNA ref T225/378
25 Department of Trade & Industry (DTI) paper, July 10, 1971, TNA ref T225/378
26 Paper to Cabinet from MoAS, July 21, 1972, TNA ref T225/378. The DTI estimated sales of 105–180 for the S.D.3-30, but lower labour costs in the Province were felt to improve the economics; in the event 141 aircraft were sold. But to underline the sensitivities here, the Minister of State for Northern Ireland noted that there was strong feeling in Catholic circles that "too large a share of public resources was devoted to Shorts and H&W". See Memorandum to the Economic Policy Committee by MoAS and MoS NI, March 13, 1973, TNA T225/378
27 Gibson, C., *Typhoon to Typhoon: RAF Air Support Projects and Weapons Since 1945*, Hikoki Publications, 2019
28 The missile division was sold to Thales in 2000

waivers, and to agree to bring forward the missile orders, with necessary adjustment to the defence budget. Launch aid for the S.D.3-30 would be made on standard DTI terms, but with money allocated from the regular public expenditure programme for Northern Ireland.[26]

This was not quite the last domestic throw of the dice in the Shorts saga. In the early 1980s the Thatcher government faced an embarrassing dilemma about the choice of the Shorts-built ALARM anti-radar missile over an American competitor. The government was keen to reinforce links with the USA, and a "politically blatant choice" in favour of ALARM might trigger a protectionist stance from the Americans in future defence sales. This might include a threat to the C-23 Sherpa (military S.D.3-30) deal with the USAF. In the event, the Cabinet felt that "difficulties facing Shorts on [its] employment record will be of higher significance". This was a reference to Irish-American republican lobbying against the Sherpa deal. ALARM was chosen, but the full USAF C-23 order was curtailed.[27]

The publicly-owned Shorts was not rolled up with BAC and HSA in the 1979 nationalisation process. The Labour government again felt that the newly formed British Aerospace might not be willing for long to concede a special status to Belfast in any subsequent rationalisation. There matters rested until 1984, when Shorts became a public limited company in preparation for privatisation by the Thatcher government.

In October 1989 Shorts was sold to Canadian manufacturer Bombardier for £30m, but with £390m of government debt written off and a further £390m to recapitalise.[28] The company prospered under Bombardier control. A deliberate effort was made to end employment discrimination and the firm emerged as a world-leader in composite wing and other aerostructure components. In 2018 Shorts won a major award for engineering excellence. In 2019 the company was put up for sale and again faced an uncertain future. In the event, the American company Spirit Aerosystems bought the Belfast complex, absorbing Shorts into a globalised aerostructures enterprise — a far cry from the trading-estate future suggested back in the 1960s.

ACKNOWLEDGMENTS *The Editor would like to thank Chris Gibson (Blue Envoy Press) for his invaluable help with the preparation of this article*

FRANCE'S AIR PIONEERS: LOUIS BLÉRIOT

In the third part of his series on "those magnificent Frenchmen" who risked their reputations, fortunes — and often lives — to further the cause of aviation across the Channel, aviation historian **JEAN-CHRISTOPHE CARBONEL** explores the rather more fanciful efforts of famous French air pioneer Louis Blériot, who applied for some "interesting" aeronautical patents

FOR READERS OF *TAH*, of course, Louis Blériot needs no introduction. What is not well-known, however, is that *Monsieur* Blériot was a very early advocate of vertical take-off and landing (VTOL), reputedly claiming that the coming-of-age of aviation would be when aeroplanes could dispense with lengthy take-off runs in the grass.

THINKING VERTICALLY

In 1900 there was still much debate about the best way to leave the ground in a heavier-than-air machine — with conventional wings or with rotors? Or both? Even the concept of the flapping-wing ornithopter was still a consideration. Blériot's first attempt at a flying-machine was a model ornithopter with a 1·5m (4ft 11in) wingspan, intended to take off vertically. Unsuccessful, the model was abandoned and Blériot began experimenting with different types of aircraft.

While refining monoplane designs with the help of Raymond Saulnier (who later became half of the famous Morane-Saulnier company), Blériot, first and foremost an inventor, applied for a patent on October 4, 1907, relating to a "device to allow aeroplanes and the like to ascend vertically". This was only applied for in France, unlike other Blériot patents. The patent describes "a method to allow aeroplanes and similar machines to ascend from a static position". It explains: "With the exception of machines fitted with a vertical axis bearing a propeller [i.e. a helicopter], there is at present no way to achieve take-off with an aeroplane or similar machine other than to run it for a distance sufficient to achieve a speed great enough to create lift, obtained by the action of inert air layers against the inclined surface of the wing while the machine moves".

It is notable that Blériot mentions only fixed- and rotary-winged aircraft in the patent — he had clearly abandoned the ornithopter concept by this time. The patent continues: "The required ground-run [of fixed-wing aeroplanes] is always lengthy, making it impossible to employ the machine except in a limited number of locations. This invention corrects such a situation".

Blériot is most famous for his development of the archetypal pre-Great War monoplane, specifically the Blériot XI, the type in which he made his historic crossing of the English Channel in July 1909. Here a Blériot XI gambols in front of spectators at Bournemouth racecourse in 1910.

BAE SYSTEMS

PHILIP JARRETT COLLECTION

LEFT ***Louis Charles Joseph Blériot was born in Cambrai on July 1, 1872, and, after establishing a highly successful automobile headlamp manufacturing business, turned his attention to aeronautical endeavours from the early 1900s. Blériot was a prodigious patent applicant, ultimately applying for more than 100 in his own name, plus many more on behalf of his various aeronautical companies.***

Blériot's first technical solution to this problem, according to the patent, was to attach the rear fuselage to a fixed point: "This neutralises the horizontal forces so that only the levitating forces remain [presumably by virtue of air being pushed over the wings by a propeller to obtain lift]. The aeroplane therefore rises from its resting position, and when the required altitude is reached, it only remains to free the machine from its attaching point . . . when the aeroplane has reached the desired height it detaches itself automatically. The desired height is dependant upon the height of the mast". This ludicrous proposition is surprising coming from a man of Blériot's intelligence and experience, and can only be seen as a proof of how little was known at the time about aerodynamics.

A second solution proposed by Blériot was to position propellers at the tip of each wing. At rest, the propellers had their axes orientated longitudinally, i.e. facing the direction of flight, which presumably contributed to the forward propulsion of the aircraft. For take-off the propellers were to be rotated 90° laterally, i.e. facing outboard, thus "blowing" the whole wing by pushing air inboard across it laterally. Blériot suggested that thrusting air across the wing in such a manner would generate lift and thus enable vertical take-off.

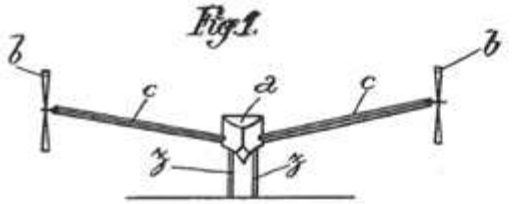
Yet another solution was to install up to four small propellers within each wing's leading edge, the propellers to be put in motion through a common drive. The patent states: "The wing being at an angle to the horizontal, the propellers generate a compression of air beneath it and a rarefaction [i.e. reduction in pressure] above it . . . hence lift is obtained from the start [of the engine] and . . . the machine rises as soon as the propellers begin their work".

This proposal was as unrealistic as the first two. Much later, similar attempts were made by Breguet to implement the idea of washing the entire wing in a flow of air to improve lift, but much time and expertise was spent trying to make it work, even with the far superior technology available in the late 1950s.

In the 21st Century, with the emergence of aircraft driven by electric motors, the idea has been resurrected to some extent, as demonstrated at the 2019 Paris Air Show by the *Deutsche Zentrum für Luft- und Raumfahrt* (German Aerospace Centre), which exhibited a model of an aircraft with 12 propellers, although this was conceived as a way to improve airflow over the wing and thus fly more economically, rather than as a VTOL application.

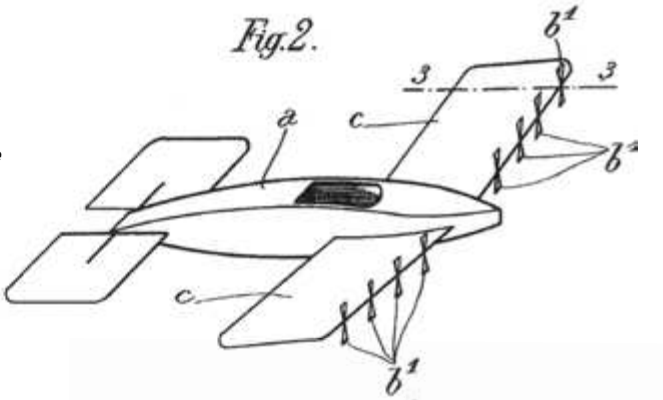
THE NEXT BIG IDEA

Another Blériot patent was applied for on October 27, 1911, and granted on March 9, 1912. This time the patent was also applied for in the UK, on December 19, 1911, and granted on May 30, 1912. Blériot must have had second thoughts about his vertical take-off ideas in between applying for the French and British patents, as the subject (and therefore the focus) of the

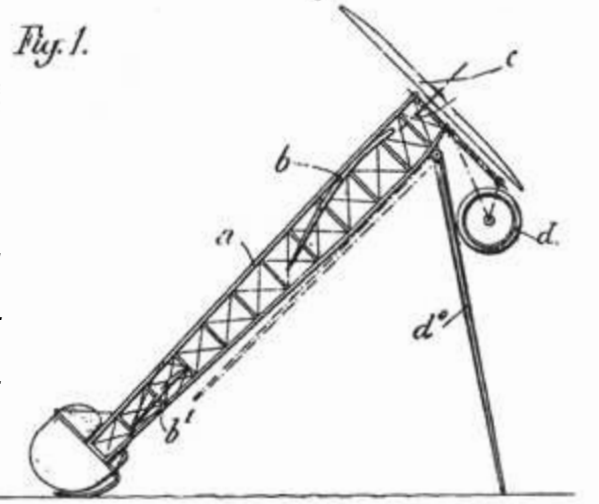


LEFT ***Blériot's French patent of October 1907, FR382530, offers a number of ideas about how to attain flight without the need for long runways. Here, Figure 1 describes the positioning of articulated propellers on each wingtip, which when oriented along the transverse axis, as seen here, would "blow" the leading edge of the wing to create lift for a vertical take-off.***

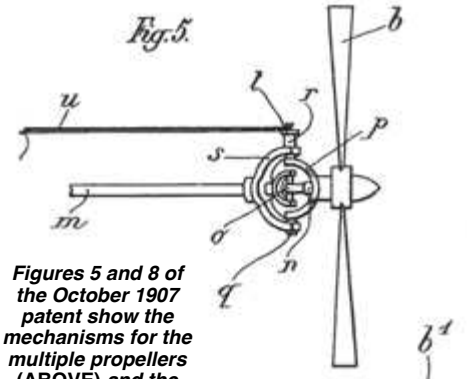
RIGHT ***Another of Blériot's ideas in the October 1907 French patent is detailed in Figure 2, which is an illustration of multiple propellers fitted along the leading edge of the wing and driven by a common shaft from the engine. With the wing set at a certain angle of incidence, the propellers would create a reduction in pressure above the wing, thus generating lift — or so the theory went . . .***



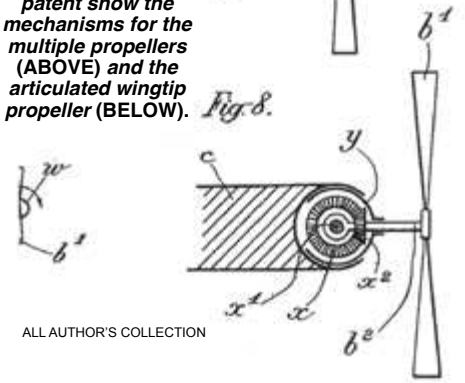
ABOVE ***Figure 4 of the October 1907 French patent shows perhaps the most outlandish of Blériot's ideas, in which the aft end of the airframe is attached to a fixed point, in this case a pole; the engine is then started and the propeller generates lift over the wings. The fuselage rises up the pole and the attachment point is released at the desired altitude — and the aircraft simply flies away. It was, of course, nonsense.***

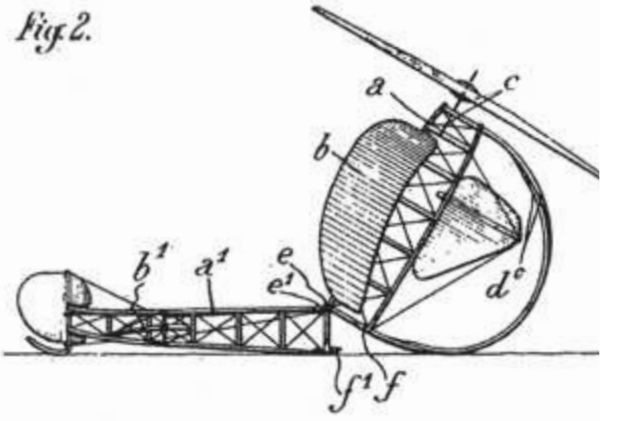


ABOVE & BELOW ***Applied for in October 1911 and granted in March 1912, Blériot's French patent FR435764 detailed two possible methods to take off "nearly vertically". The first (Figure 1) shows a stowable frame or chassis attached to the fuselage to set the aircraft at a 45° angle for take-off. Figure 2 describes an articulated forward section which would "snap" together with the rear fuselage as lift was generated.***

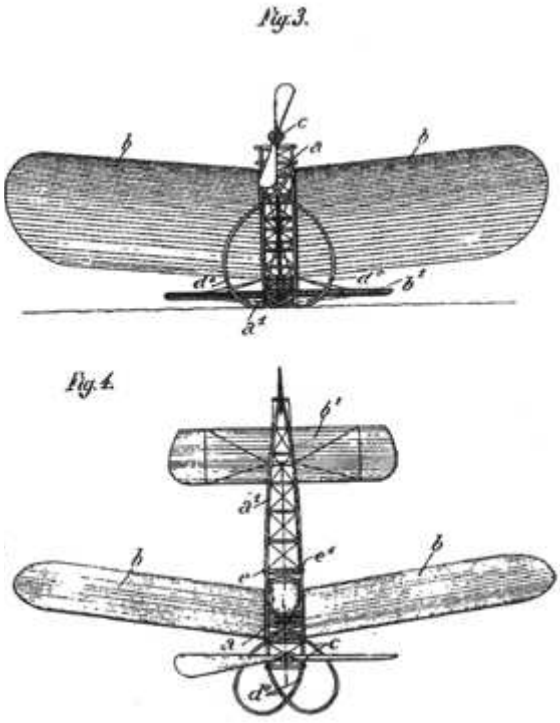


***Figures 5 and 8 of the October 1907 patent show the mechanisms for the multiple propellers* (ABOVE) *and the articulated wingtip propeller* (BELOW).**





ALL AUTHOR'S COLLECTION



AUTHOR'S COLLECTION x 2

LEFT ***In Blériot's British patent, GB28638, granted two months after the French patent, only the articulated fuselage concept remains. The Frenchmen had clearly had second thoughts about its value as a VTOL system, choosing instead to focus on the usefulness of the pivoted joints in the fuselage for the transport and storage of aircraft in confined spaces.***

patent is different in each. In France the subject of the patent was "to expose ways to enable [aeroplanes and such machines] to take off on the spot without encountering the difficulties inherent in previously known ways". The British version, however, "relates to aeroplanes and similar machines, and comprises improvements in the type of aerial machines in which certain elements can be folded upon others, with the use of pivoted joints, whereby transport and storage can be facilitated". The illustrations remained exactly the same in both patents, but the French version included an additional drawing showing a chassis to set the fuselage at 45° for take-off. The chassis was articulated at the front of the fuselage and could be folded underneath the fuselage during flight.

In the British version, the vertical take-off aspect is alluded to: "When it is desired to make a flight and only a limited ground is available for starting", the fuselage sections may be disconnected so that the front section, with the engine and the propeller, points toward the sky, so that when the engine is started it directly lifts the machine. When the two fuselage sections are at 180° (that is, they are aligned), then the pilot may reconnect them by means of latches (in the French patent the latches appear to be self-locking, although this is less obvious in the British version). All this was extremely optimistic to say the least, and no solution is offered for vertical landing.

Blériot recommended the use of an engine more powerful than would be required just for conventional flight if "vertical ascent" was to be attempted. For take-off, he suggests the propeller should be "geared down, and at the same time elastic [sic] and with variable pitch". What Blériot meant by "elastic" remains unknown.

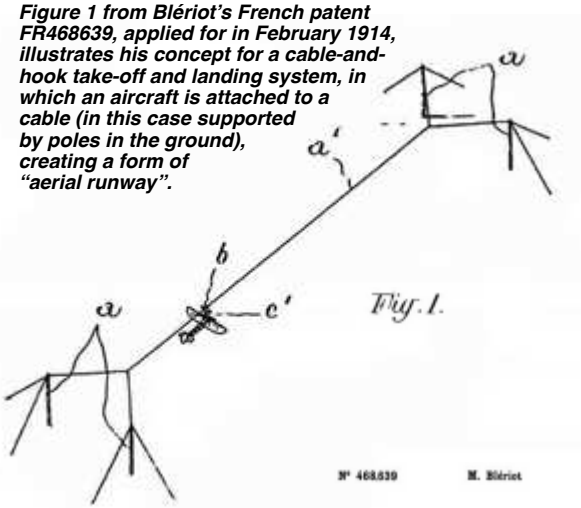
Even if it was wildly optimistic, not everything in the patent was so fanciful; the reinforced undercarriage described in the patent was used on Blériot's aeroplanes, including the Channel-crossing Type XI in 1909. As described in the patent, the mainwheels had a "kneeling" position so that for storage the fuselage would be approximately horizontal when laying on the front wheels and mid-section skids.

AN IDEA AHEAD OF ITS TIME

On February 19, 1914, Blériot applied for another patent, this one for "improvements to devices to enable aeroplanes and the like to take off and stop at determined points, mainly on ships". The idea was to install a long line of cable, upon which an aircraft could be hung by means of a hook. For use on a ship, the taut cable would be positioned to run outside the ship's hull. The aeroplane would run along the cable to acquire the speed necessary to obtain lift before releasing the hook from the cable and flying away. On its return, the aircraft was to be flown back on to the wire and re-hooked before the engine was cut, after which it would slide to a stop.

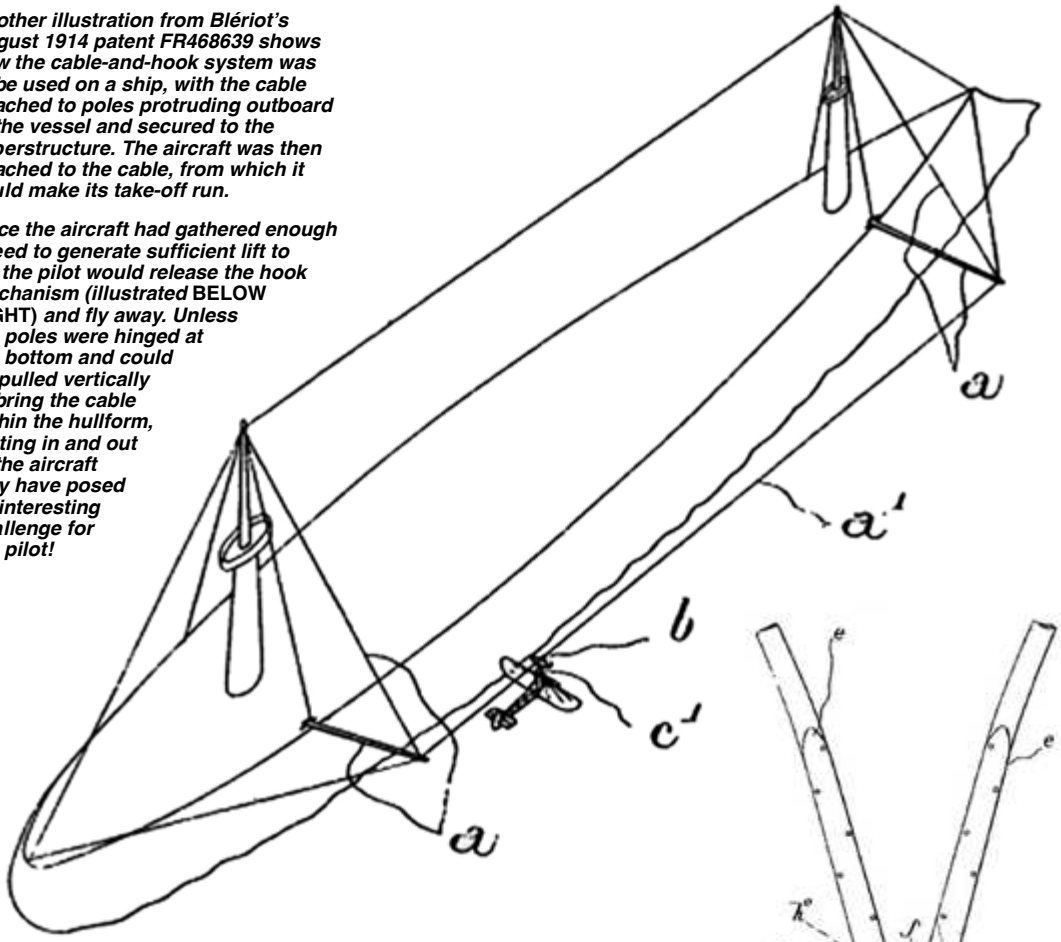
This method was successfully demonstrated by famous French pilot Adolphe Pégoud in July 1913 (fresh from obtaining his *brevet de pilote* on March 6 that year, Pégoud had been recruited by Blériot as a test pilot). A cable of 80m (263ft) was

Figure 1 from Blériot's French patent FR468639, applied for in February 1914, illustrates his concept for a cable-and-hook take-off and landing system, in which an aircraft is attached to a cable (in this case supported by poles in the ground), creating a form of "aerial runway".

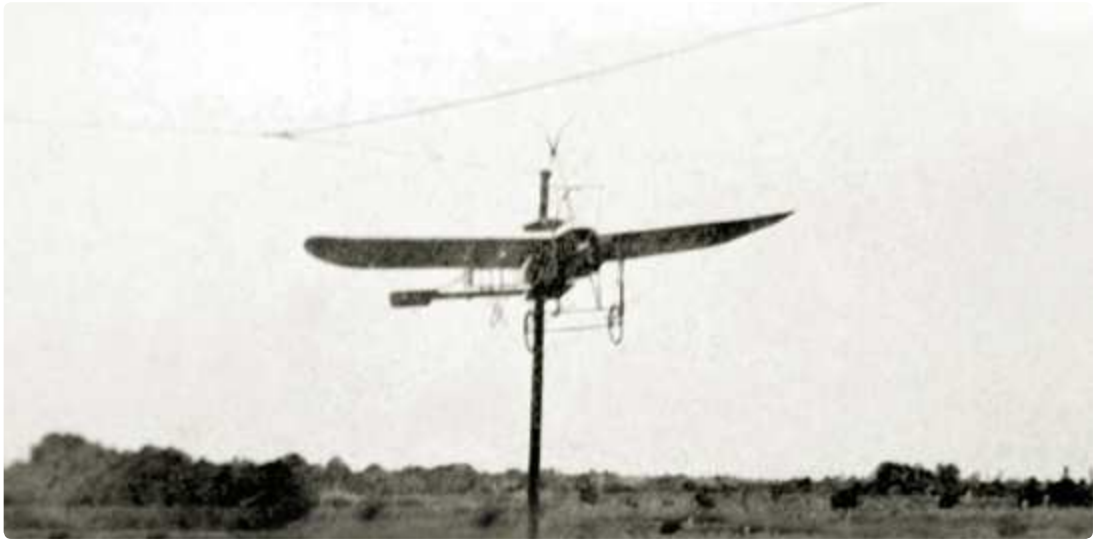


Another illustration from Blériot's August 1914 patent FR468639 shows how the cable-and-hook system was to be used on a ship, with the cable attached to poles protruding outboard of the vessel and secured to the superstructure. The aircraft was then attached to the cable, from which it could make its take-off run.

Once the aircraft had gathered enough speed to generate sufficient lift to fly, the pilot would release the hook mechanism (illustrated* BELOW RIGHT*) and fly away. Unless the poles were hinged at the bottom and could be pulled vertically to bring the cable within the hullform, getting in and out of the aircraft may have posed an interesting challenge for the pilot!



BELOW ***A rare photograph of Adolphe Pégoud demonstrating the cable-and-hook system with a ground-based structure and a Blériot XI. From the positioning of the aircraft at the beginning of the aerial runway, it is likely that Pégoud is bringing the machine in to alight on the wire after having accomplished a successful take-off and circuit of the flying ground.***



AUTHOR'S COLLECTION x 3

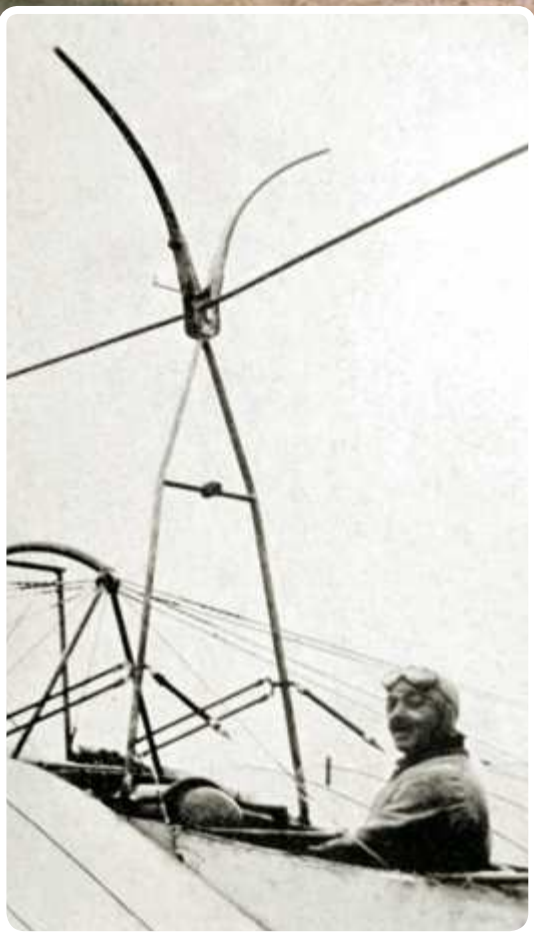
Although many of Blériot's aeronautical patent applications were wishful thinking at best, the cable-and-hook system did ultimately prove practicable and was used operationally on ships during the Second World War, although whether Blériot's patent was an influence is unknown. This Piper L-4, N50364/43-1439, based at Anoka, Minneapolis, is fitted with the hook used with the Brodie shipborne cable-and-hook system.

FLUGKERL2

erected between two masts on the airfield at Buc (near Versailles), which had been established as a test base by Blériot in 1910. Pégoud successfully flew from and back on to the cable in a modifed Blériot XI. For take-off, the Anzani engine was started and the monoplane began to slide along the cable. When sufficient speed had been reached Pégoud opened the hook and dropped the aircraft by 1m (3ft). Once fully disengaged from the cable, Pégoud banked his machine and flew away. On his return, Pégoud flew a metre beneath the cable before slowly climbing, re-engaging the hook and cutting his engine. He successfully repeated the demonstration numerous times.

The prospective installation aboard a ship was seen as being relatively easy to achieve and had the advantage of not impeding the travel of the ship's gun turrets. Any such experiment was received with much reservation by the press, however, which pointed out that while it may be one thing to perform the stunt between two masts solidly anchored in the ground, it would be another to do the same aboard a ship rocking in a rough sea. *Capitaine* Lafon, in *La Revue Aérienne*, even claimed the idea was not Blériot's at all, but had been first proposed by *Ingénieur* Léon Levavasseur in 1910.

Notwithstanding the misgivings of the contemporary press, it is the only one of Blériot's unusual inventions covered in this article to be developed into an operational system. During the Second World War, an almost identical system was put into practice by US Army Capt James Brodie using specially modified Piper and Stinson liaison aircraft. But that, as they say, is a whole other story . . .



AUTHOR'S COLLECTION

ABOVE ***Adolphe Pégoud in the cockpit of the Blériot XI fitted with the hook and suspended from the wire. Pégoud was Blériot's favoured test pilot and undertook numerous flights in which he "pushed the envelope" of what was possible with an aircraft in terms of manœuvrability. Pégoud was the first pilot in Europe to fly inverted and perform a loop, in 1913.***

TWO DAYS IN FEBRUARY

THE SIDI BOU ZID AIR WAR PART 1

By early 1943 the Allies had made steady progress eastwards along the North African coast to Tunisia, where the Axis forces were compelled to take a final stand to avoid being thrown back into Italy. **Dr ANDREW ARTHY** opens a forensic two-part series on the little-covered air combat operations of both sides during the battle for Sidi Bou Zid on February 14–15, 1943

TOP HOWARD LEVY / BELOW EN ARCHIVE

THE BATTLE OF Kasserine Pass is largely remembered as a great land battle, and as German *Generalfeldmarschall* Erwin Rommel's last North African success. However, the aerial conflict over the battlefield was just as intense as the clashes on the ground, and this was particularly the case during February 14–15, 1943, as the Allied and Axis armies fought for control of a small Tunisian settlement named Sidi Bou Zid. Those two days saw almost complete German dominance over an inexperienced foe on the ground and in the air, as Supermarine Spitfires, Focke-Wulf Fw 190s, Messerschmitt Bf 109s, Bell P-39 Airacobras, Junkers Ju 87 Stukas and various other fighters, reconnaissance aircraft and bombers were thrown into the confused aerial fighting.

Prominent fighter aces and ground-attack specialists were involved on both sides, including Heinz Bär (221 aerial victories), Erich Rudorffer (224), Kurt Bühligen (112), Fritz Schröter (400+ missions), Erhard Jähnert (611 missions), Harrison R. Thyng (an ace in the Second World War and Korea) and Jerry D. Collinsworth (six victories). In the space of two days 50 Axis and Allied aircraft involved in the battle were destroyed or damaged, emphasising how ferocious the air fighting was. This was an intense and action-filled period, yet has received scant attention from aviation historians; a situation this two-part article will attempt to address.

THE LAND WAR SITUATION

Since November 1942, after Rommel's defeat at El Alamein in Egypt and the Anglo-American invasion of Morocco and Algeria, the Axis armies in the Mediterranean had been put firmly on the defensive. By early February 1943 the last Axis forces had been expelled from Libya, leaving eastern Tunisia as their only foothold in North Africa. Desperate to stave off a looming defeat, the Germans and Italians decided to launch an offensive against the Allies in central Tunisia. There was to be an initial attack aimed at securing the settlement of Sidi Bou Zid, gateway to the strategically vital Kasserine Pass.

The Sidi Bou Zid area was held by American forces of Combat Command A of the US Army's 1st Armored Divison, under II Corps, and two hills on either side of the village were seen by the Americans as the keys to its defence: Djebel Lessouda to the north and Djebel Ksaïra to the south-east. On the evening of February 13 the Americans at Sidi Bou Zid were well aware of Axis intentions, and forward defenders could hear the rumble of tanks to the east. However, being aware of the threat and being able to deal with it would prove to be two different things.

During February 14–15, 1943, the Sidi Bou Zid air fighting was a contest between one very inexperienced air force — the USAAF — and one extensively battle-hardened opponent (the Luftwaffe). The Germans also had an initial advantage in numbers, as they committed much of their African air force to the opening days of the battle, while the Allies responded primarily with only the local American tactical air command.

FORGED IN BATTLE: THE LUFTWAFFE

The overall Luftwaffe headquarters in Tunisia was *Fliegerkorps Tunis*, under *Generalmajor* Hans Seidemann, with two subordinate commands: *Fliegerführer 2* in northern Tunisia and *Fliegerführer 3* in the south. Fliegerkorps Tunis was a powerful tactical air force,[1] its fighter-bomber, dive-bomber and short-range reconnaissance aircraft capable of intervening with great effect in the land battle, all supported by experienced fighter pilots.

Supply shortages, however, meant Luftwaffe aircraft serviceability figures were poor, and most Fliegerkorps Tunis units were under full strength. On February 14 Fliegerkorps Tunis had a serviceability rate of just 64 per cent, and only one *Gruppe* had more than 20 operational aircraft. In all, on February 14 Fliegerkorps Tunis had a total of around 324 aircraft, but taking into account serviceability and units actually committed, only some 120 were available for the offensive. However, in the opening days of the battle even this relatively small number was able to create an indelible impression on American ground troops. American Army reports of February 14 and 15 featured phrases such as: "Enemy aviation apparently unopposed", "Enemy 'planes overhead continuously" and "Stukas seemed to be shuttling their loads from very close airfields".

The main German forces committed to the Sidi Bou Zid air battles were the fighters of II./JG 2 and JG 77, the fighter-bombers of III./SKG 10, the dive-bombers of StG 3 and the reconnaissance aircraft of 4.(H)/12, 2.(H)/14, and 1.(F)/121. The Bf 109-equipped JG 77 *"Herz As"* ("Ace of Hearts") was a vastly experienced unit, home to many aces: I./JG 77 was led by the renowned *Hauptmann* (Hptm) Heinz "Pritzl" Bär, who by this time had 154 aerial victories to his credit; II./JG 77 was commanded by the highly experienced *Major* Anton Mader, and III./JG 77 was under the command of 105-victory ace Maj Kurt Ubben. There were two prominent *Experten*

OPPOSITE PAGE, TOP ***Supermarine Spitfire VC (Trop) ES317, MX-F, seen here at Ponte Olivo airfield on Sicily in August 1943, served with the 307th FS, 31st FG, during the air operations over Sidi Bou Zid six months previously.***
OPPOSITE PAGE BOTTOM ***A Focke Wulf Fw 190 of Luftwaffe unit SKG 10 taxies out with a bomb for another sortie.***

Based at Thelepte in Tunisia from late January 1943, the 81st FG operated three Bell P-39 units — its own 91st and 92nd FSs and the 350th FG's 346th FS. Its unusual mid-mounted engine gave the type an excellent field of vision from the cockpit and its mixed armament of wing- and nose-mounted 0·50in machine-guns and a 37mm cannon firing through the propeller hub packed a powerful punch, especially for ground-attack missions.

NIAGARA AEROSPACE MUSEUM VIA VALERIY ROMANENKO

in the ranks of II./JG 2 — Hptm Erich Rudorffer and *Oberleutnant* Kurt Bühligen — while StG 3 was also a very experienced and well-led unit, and a veteran of the desert fighting.

Numerically, the Italian *Regia Aeronautica* was still strong in the Mediterranean theatre, but it would play almost no role at all in the actions of February 14 and 15.

THE INEXPERIENCED USAAF

Unlike the Luftwaffe, the USAAF in north-west Africa was not focused on direct tactical army support, and it would take several days before it reorientated its efforts to the battle area. Initially, the USAAF's XII Air Support Command (XII ASC) was the primary Allied command involved in the Kasserine air fighting, and the only air units initially committed to the Kasserine sector were American (plus one French fighter group).

Established to provide tactical support to Allied ground troops in central Tunisia, XII ASC learned many harsh lessons during its early existence, with heavy losses in both personnel and aircraft. Further lessons would follow during the Sidi Bou Zid fighting. The Command's units were primarily based at two airfields on February 14 — Thelepte and Youks-les-Bains.[2] The former was just inside Tunisia, the latter in eastern Algeria.

The early stages of the battle saw the inexperienced 31st Fighter Group (FG) undergo a real baptism of fire, and it was soon joined by another novice Spitfire unit, the 52nd FG. The 47th Bombardment Group (BG) used its Douglas A-20s to strike Axis targets, and *Groupe de Chasse* (GC) II/5 with Curtiss P-40s was a Free French fighter unit subordinate to XII ASC.

Aside from the Spitfire, P-40 and A-20, the other major American tactical aircraft available was the much-maligned Bell P-39. One of its pilots wrote:

"The P-39 looked like an airplane, kind of flew like one, and undoubtedly was the poorest, worst airplane that American pilots had to fly in combat . . . one bullet into the coolant system put the engine out of order in just one minute. It was easy to hit a high-speed stall when racking it into a turn. Once stalled, the airplane would sometimes tumble nose-over-tail at about a 30° angle."

It also had its defenders, however, with another pilot noting that "it proved to be an outstanding strafing platform — possibly the best anywhere. Visibility was superb and [it] was so light and responsive on the controls that it could be flown a few feet off the deck until a target was spotted".

One former P-39 pilot wrote the following of the type's role in North Africa at this time:

"As we had no bombs, our primary job was to find and strafe Rommel's columns. We usually flew at a maximum cruise speed of 275 m.p.h. [443km/h], right down on the deck.[3] When we found them we raked them with our 37mm cannon[4] and six machine-guns, but would only make a single pass."

Importantly, the Americans had no fighter-bombers or dive-bombers with which to provide close air support — a key weakness compared to the Luftwaffe in Tunisia. Another advantage for the Germans was that the Fw 190A and Bf 109G were slightly superior to the Spitfire Mk V, P-40 and P-39, and as capable as the Lockheed P-38. Aside from XII ASC, if an emergency situation arose, the Allies could call on Boeing B-17s, North American B-25s and Martin B-26 Marauders based in Algeria under XII Bomber Command.

The Axis forces planned to begin their offensive at dawn on February 14 with a drive towards Sidi Bou Zid from two directions — 10. Panzer-

THE LUFTWAFFE IN TUNISIA, MORNING OF FEBRUARY 14, 1943

Unit	Location	Type	Strength	Svc'ble*	Crew	Ready	Transferring
Fliegerkorps Tunis La Fauconnerie							
Fliegerführer 2	Tunis						
II./JG 2	Kairouan Bizerte & Tindja	Fw 190A Fw 190A	23	18	28 (13)**	18	To Kairouan
Stab JG 53	Bizerte	Bf 109G-2	5	4	7 (6)	4	To Kairouan
I./JG 53	Bizerte	Bf 109 G	27	20	54 (18)	21	—
II./JG 53	La Marsa & El Aouina	Bf 109G-4	37	29	52 (18)	30	—
III./SKG 10	Bizerte	Fw 190A	28	11	26 (12)	19	To Kairouan
II./StG 3	St Marie du Zit & El Aouina	Ju 87D	27	13	29 (12)	12	One Staffel to Gabès
8.(Pz.)/SchG. 2	El Aouina	Hs 129	10	4	12 (3)	5	Five aircraft to Gabès
2.(H)/14	La Marsa & El Aouina	Bf 109	11	6	18 (9)	14	One Rotte to Kairouan One Rotte at Gabès
Kurierstaffel	La Marsa & El Aouina	Various	9	8	10	5	—
4./MSGr 1	Bizerte	Ju 52/3m MS	2	2	2	2	—
	Tunis	Ju 52/3m MS	1	0	1	1	—
Total			**180**	**115**			
Fliegerführer 3	Gabès						
II./JG 51	Gabès	Bf 109G-2	6	0	41 (14)	12	To Sicily and Sardinia
		Bf 109G-4	1	0			
Stab JG 77	Matmata	Bf 109G-2	unknown	3	5 (3)	3	—
I./JG 77	Fatnassa	Bf 109G-2	23	12	54 (15)	37	—
II./JG 77	Medenine	Bf 109G-2	19	18	48 (18)	32	To La Fauconnerie
III./JG 77	Matmata	Bf 109G-2	32	20	54 (17)	32	To Maknassy
I./SchG 2	Medenine	Bf 109F-4	19	10	48 (11)	17	—
III./StG 3	Gabès	Ju 87D	20	14	22	15	To Mezzouna
4.(H)/12	Gabès-West	Bf 109F-4 Bf 109G-2	2 2	2 2	12	7	—
2.(H)/14 det.	Gabès-West	Bf 109G-2	2	1	2	2	—
1.(F)/121	Gabès-West	Ju 88D-1	6	5	9	8	—
1. Wüstennot-staffel	Matmata	Fi 156 Fw 58	8 1	7 1	15	7	—
Total			**141+**	**95**			

* Serviceable

** Number in brackets = of which officers or pilots in operational command of a crew

RIGHT ***In February 1943 Luftwaffe operations in Tunisia were under the direct control of*** **Generalmajor** ***Hans Seidemann, commanding officer of*** **Fliegerkorps Tunis,** ***divided into*** **Fliegerführer 2** ***in the north of the country and Fliegerführer 3 in the south. By May 1943 Seidemann had been transferred to command Fliegerkorps VIII on the Eastern Front to participate in the vital Battle of Kursk during July—August 1943. He survived the war and died in 1967.***

USAAF XII AIR SUPPORT COMMAND, FEBRUARY 14, 1943

Unit	Sub-Unit	Type	Location	CO	Comments
HQ 31st FG		Spitfire V	Thelepte No 1	Col Fred M. Dean	
	307th FS/31st FG	Spitfire V	Thelepte No 1	Maj George J. LaBreche	
	308th FS/31st FG	Spitfire V	Thelepte No 1	Maj Delwin B. Avery[5]	
	309th FS/31st FG	Spitfire V	Thelepte No 1	Maj Harrison R. Thyng	
HQ 81st FG		P-39	Thelepte No 2	Lt-Col Kenneth S. Wade	
	91st FS/81st FG	P-39	Thelepte No 2	Maj Jack W. Wertz	
	92nd FS/81st FG	P-39	Thelepte No 2		
	346th FS/350th FG	P-39	Thelepte No 2	Capt John C. Robertson	Rest of FG at rear
HQ 47th BG		A-20	Youks-les-Bains	Col Frederick R. Terrell	
	84th BS/47th BG	A-20	Youks-les-Bains	Maj Walter J. Hanna	
	85th BS/47th BG	A-20	Thelepte	Maj Reginald J. Clizbe	
	86th BS/47th BG	A-20	Youks-les-Bains	Maj Richard E. Horner	
	97th BS/47th BG	A-20	Thelepte	Capt Marion J. Akers	
154th OS/ 68th OG		P-39	Youks-les-Bains	Maj John R. Dyas	
GC II/5		P-40	Thelepte	*Commandant* Paul Stehlin	

Division westward through the Faid Pass, while mobile elements of 21. Panzer-Division undertook a southerly route around the mountains before emerging through the Maizila Pass to drive two *Kampfgruppen* north and north-eastwards towards Sidi Bou Zid. This was to be a local attack aimed at capturing the village and annihilating the American defenders of Combat Command A, and the German army had much greater strength in the initial battle area.

The overall orders for the aircrews of Fliegerkorps Tunis were straightforward:

"Fliegerführers 2 and 3 are requested to support the attack by committing their strongest forces. It is a question of destroying the enemy forces located west of the Faid defile, and of preventing the enemy forces in the Sbeitla-Tebessa area from coming to their aid."

For the operation, German fighters and ground-attack aircraft were to be based at Kairouan, and Stukas and fighters at Mezzouna, Maknassy and Gabès. Consequently several transfers were ordered on the evening of February 13. Instructions were given for II./JG 2 and III./SKG 10 to transfer at dawn to Kairouan, and Maj Günther Freiherr von Maltzahn's *Stab* (literally "staff" flight) of JG 53 was also to go to Kairouan. A *Staffel* of Ju 87s was to be sent by II./StG 3 to Gabès; a pair of 2.(H)/14 Bf 109s was intended for Kairouan, and 8.(Pz)/SchG 2, with its Henschel Hs 129 anti-tank aircraft, was to transfer from northern Tunisia to Gabès. With plans in place and orders sent, both sides were ready for battle to commence.

THE OFFENSIVE BEGINS

The day of the German offensive dawned cloudy with limited visibility, but this gradually improved as the day progressed. The Panzers began to roll shortly before sunrise, and 10. Panzer-Division made first enemy contact near Djebel Lessouda at 0630hr. Meanwhile, 21. Panzer-Division reached the Maizila Pass unhindered and began emerging from it, with one Kampfgruppe going west and another going north towards Sidi Bou Zid.

As the tanks pushed forward, the offensive was supported by a German bomber strike from a handful of Sicily-based Ju 88s — it was a long way from previous German pre-offensive bombing blitzes! Just nine aircraft from KG 76 and KG 54 were involved, taking off in the dark to attack the town of Sbeitla, 25 miles (40km) north-west of Sidi Bou Zid. They reached the

BELOW ***A Henschel Hs 129 tank-buster of* 8.(Panzer) / Schlachtgeschwader 2 *hides among wine barrels filled with sand at El Aouina, near Tunis, in early February 1943. The unit moved five Hs 129s to Gabès for the action at Sidi Bou Zid; little is known about their use beyond one Hs 129B-2 being lost owing to engine failure on February 15.***

EN ARCHIVE

O'BOYLE VIA AUTHOR

ABOVE ***Combat crews of the 97th BS, 47th BG, pose in front of one of the unit's Douglas A-20s at Thelepte. Part of the Twelfth Air Force, the 47th BG had arrived in North Africa in early November 1942. Its actions in Tunisia, specifically during the Axis breakthrough at Sidi Bou Zid and Kasserine Pass in February 1943, earned the 47th BG a Distinguished Unit Citation.***

target area soon after 0600hr, and several aircraft attacked the town itself, while others hit vehicles and tanks in the immediate vicinity. KG 54 had particular difficulty in locating Sbeitla because of ground haze; and, with increasing daylight and no fighter escort, only one KG 54 pilot pressed home an attack on the village itself. The German bombers undoubtedly caused the Allies great consternation, because by this date nocturnal and dawn Luftwaffe raids near the front line were exceedingly rare.

With US Army outposts east of Sidi Bou Zid overrun without providing warning of the Axis attack, it was a confused situation for Combat Command A. Soon after sunrise (0709hr), the Luftwaffe added greatly to the confusion. With the coming of daylight, the Ju 87s of StG 3 struck their objective, the village of Sidi Bou Zid. A total of 16 delayed-action bombs was dropped, which then exploded in short intervals from 1100hr, causing immense damage. One member of the 1st Armored Division later wrote: "the village was destroyed by German dive-bombers". The Stukas took off from Gabès for this mission, but landed at Mezzouna, putting them some 50 miles (80km) closer to the battlefield.

The early land engagements went much in favour of 10. Panzer-Division. The German tanks were soon rounding the northern edge of Djebel Lessouda, then drove south towards Sidi Bou Zid, isolating the American Lessouda Force in the process. Oblivious to events at Sidi Bou Zid, at 0717hr Spitfires of the 308th FS took off from Thelepte to fly a scheduled escort for eight P-39s of the 81st FG to the southern part of the XII ASC sector, around El Guettar and Sened. One American pilot described it as "a shoot-up", and various targets were seen and strafed, but their route took them nowhere near Sidi Bou Zid.

Some 15min later the second XII ASC mission of the day left Thelepte, and flew straight into trouble. This time it was the 309th FS escorting two P-39s directly to Fondouk, a town just north of the main battle area. However, the P-39s failed to follow the prescribed course, and

BELOW ***Seen here in the standard RAF desert scheme of Dark Earth and Mid Stone camouflage with Azure undersurfaces, Spitfire VB (Trop) EP837, HL-L, served with the 308th FS, 31st FG, during the air battle over Sidi Bou Zid in February 1943. Artwork by JUANITA FRANZI / AERO ILLUSTRATIONS © 2020***

EN ARCHIVE

ABOVE ***Still wearing its factory codes, a Focke-Wulf Fw 190A-5 of II./JG 2 undergoes engine maintenance at Tindja, near Bizerte, in early 1943. The unit used its Fw 190s strictly for the dogfighting role, whereas those of*** **Schnellkampfgeschwader 10** ***(Fast Bomber Wing 10) were equipped with a 250kg or 500kg general-purpose bomb on the fuselage centreline.***

the mission took them over Kairouan, and the hunting ground of II./JG 2. Unsurprisingly, the Americans were bounced just south of the town by eight Fw 190s led by 4./JG 2 *Staffelkapitän* Oblt Kurt Bühligen, which had been scrambled on the enemy's approach. One P-39 was shot up and made a forced landing at base, and 1st Lt Richard L. Bisgard's Spitfire was damaged, forcing him down just inside friendly territory. He was picked up by the French and made it back to his unit by mid-afternoon, where the doctor told him to take Benzedrine tablets.

The German pilots were somewhat optimistic in their victory claims (three Spitfires destroyed and one Airacobra damaged), but this was still a very one-sided engagement: only one of the Spitfires managed to open fire. Ominously, the American pilots reported seeing a large concentration of aircraft at Kairouan, indicating its immediate importance to the Germans.

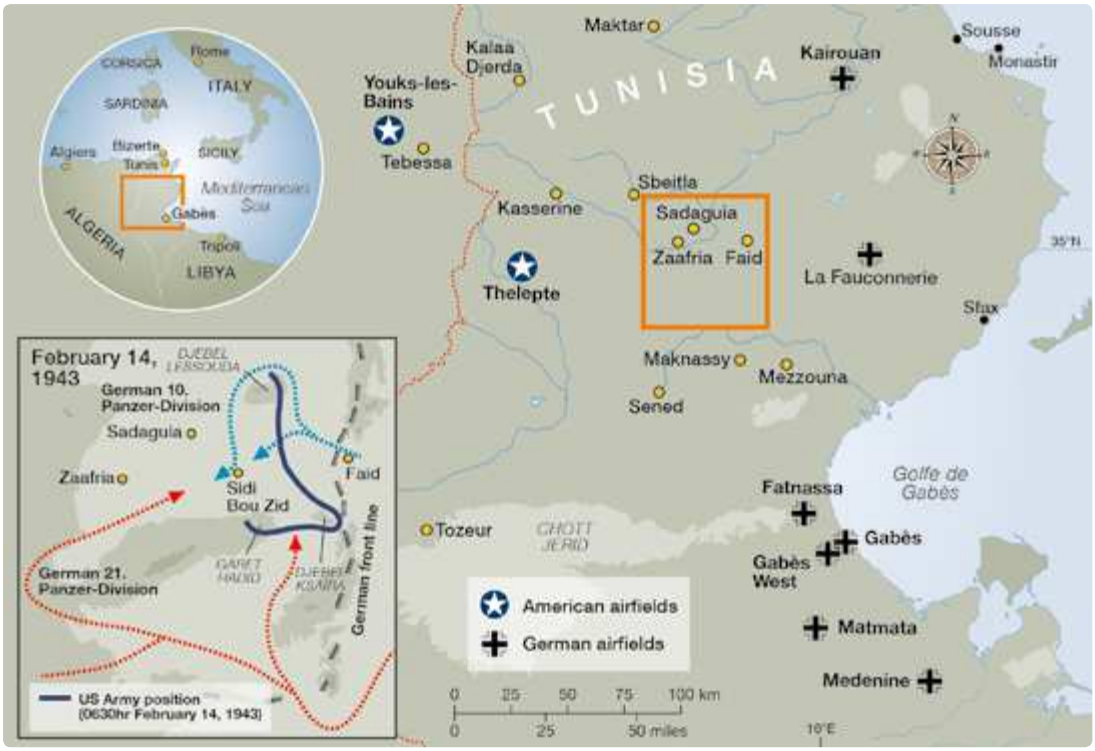
Generalmajor Seidemann was well-satisfied with these early German operations, telling his superior Generalfeldmarschall Albert Kesselring as much at 0930hr. He accurately described Allied air activity as "very slight", while at 0840hr a very frustrated Combat Command A had noted: "No friendly aviation seen as yet. (Observation had been requested at 0100hr from daylight on)".

ALLIED FIGHTBACK

At the exact minute Combat Command A made that observation, the next XII ASC mission left Thelepte, and it would make the first appearance by Allied aircraft over the Axis advance, albeit only a fleeting one. Spitfires of the 307th FS took off from Thelepte under Commanding Officer (CO) Maj George J. LaBreche, to escort eight P-39s on a strafing mission, their path taking them directly over the advancing 21. Panzer-Division. In fact, they would provide the first opposition encountered by the German unit on February 14; it reported a strafing attack on *Panzergrenadier-Regiment 104* at 0920hr. The Americans strafed 100 troops and claimed 40 to 50 of them as killed, but the Germans noted no casualties from this attack. The P-39 piloted by flight leader Capt James R. Hillin was hit by anti-aircraft fire moments after he was involved in a tragic collision with a Tunisian shepherd — the P-39s really did operate at low altitude! — the American crash-landed and was taken prisoner.

Although they had been supposed to transfer at dawn, in the event it was not until 0945hr that III./SKG 10 and the rest of II./JG 2 actually arrived at Kairouan from Bizerte for operations. This provided Fliegerkorps Tunis with another potent ground-attack weapon. It would not be long before the new arrivals were airborne.

Meanwhile, at 0940hr the Americans received



MAP BY MAGGIE NELSON

their first reports from army reconnaissance troops about 21. Panzer-Division's drive from the Maizila Pass, confirmed by the 81st FG following its mission. This added yet another headache for Combat Command A.

Back at Sidi Bou Zid, an American armoured force under Lt-Col Louis V. Hightower had been ordered to clear up the situation, and at 0920hr his 51 tanks moved forward to attack. Between then and 1100hr Hightower's tanks were involved in heavy armoured engagements to the north of Sidi Bou Zid.

Launching its second mission of the day at 0955hr, this time with only eight Stukas, StG 3 targeted American armour in Sidi Bou Zid and to its north. The Stuka attack was reported as being successful by 10. Panzer-Division, and it was this Ju 87 mission that severely delayed the movement forward of some important supporting American artillery. Hightower recalled that the bombs caused little damage to his tanks, but "smoked us up so that we couldn't see through the dust", thereby disrupting his attack.[6] After Hightower's tank crews had reorganised, they were hit by German Panzer VI Tigers.

In the sky above the Stukas, the escorting Bf 109Gs of JG 77 had encountered an American bomber unit which they reported was escorted by P-38s[7] and Spitfires, but claimed no successes. This American formation was the first XII ASC mission sent directly to Sidi Bou Zid, some five hours after the offensive began. It comprised nine 47th BG A-20s, six 68th Observation Group (OG) P-39s and six French GC II/5 P-40s, with a dozen 308th FS Spitfires for high cover. The target for the A-20s was a German tank concentration in Faid Pass, which was hit at 1108hr and well-covered with bombs.

The Stuka attack was soon followed by five Fw 190 fighter-bombers of III./SKG 10, airborne between 1045hr and 1120hr and escorted by six fighters of II./JG 2. The fighter-bombers each carried one 500kg (1,100lb) bomb, and attacked Hightower's force in and near Sidi Bou Zid. These pilots reported encountering no resistance from groundfire, indicating just how disorganised the Americans had become by this time.

A TACTICAL RETREAT

Despite the bravery of the American tank crews, within a few hours almost all of their armoured vehicles were destroyed. With the situation dire, by noon withdrawal was the only American option. This now left the troops on Djebels Lessouda, Ksaïra and Garet Hadid (another hill south-east of Sidi Bou Zid) completely isolated. The American retreat also provided the Luftwaffe with a plethora of targets, as disorganised troops, vehicles and guns fell back through Sidi Bou Zid and streamed to the west, south-west and north-west. The Stukas and fighter-bombers took full advantage of the opportunity, flying multiple missions during the late morning and early afternoon to stoke the chaos.

As III./SKG 10 conducted its initial attack, the escorting II./JG 2 pilots, led by Oblt Kurt

AUSBORN VIA VINCENT

ABOVE ***Seated here in the cockpit of his WZ-coded 309th FS, 31st FG Spitfire, Lt Charles E. Wilson undertook three missions during the action over Sidi Bou Zid on February 14, 1943. The unit flew its Spitfires throughout the Tunisian and subsequent Italian campaign until the spring of 1944, when it was re-equipped with P-51 Mustangs.***

Bühligen, encountered the same XII ASC formation as JG 77. The P-39s and Frenchmen of GC II/5 were jumped near Sidi Bou Zid, with the 31st FG Spitfires attempting to come to their rescue. However, the efforts of the American fighter pilots were largely frustrated by guns not firing owing to sand in the mechanisms; the leader of the Spitfire pilots involved reported that only one of his four 0·303in-calibre machine-guns fired. A member of the 31st FG wrote in his diary that "the boys were jumped and had a fair scrap but the guns wouldn't shoot due to sand".[8]

The Germans claimed six Spitfires destroyed, one damaged and two P-40s damaged, including a pair of victories each to Oblt Bühligen and the very experienced *Oberfeldwebel* (Ofw) Goltzsch. However, this seems to be another case of optimistic claiming, given that no American or French aircraft were actually lost, and only one P-40 was damaged. The Germans also incorrectly believed that they had forced the A-20s to jettison their bombs over Allied territory. These two Luftwaffe attacks by StG 3 and III./SKG 10 had played an important part in pinning down and disrupting Hightower's force while German armour closed in on it.

While the tank battle raged at Sidi Bou Zid, at 1040hr XII ASC had despatched its second bombing mission of the day, but this was to Sened in the south, an uneventful show with 34 demolition bombs dropped on target. Their escorting P-39s also attacked ground targets. The Americans were yet to switch their close air support priorities, despite the developing crisis.

THE MAYHEM CONTINUES

Just before noon StG 3 was back in the Sidi Bou Zid area, bombing the Americans' retreating artillery, tanks and vehicles. Later awarded the *Ritterkreuz*, *Leutnant* Erhard Jähnert was one of those involved, on his 274th mission of the war. The 11 escorting JG 77 Bf 109s joined in the

Based at Thelepte, the French* Armée de l'Air's Groupe de Chasse II/5 *operated a small force of Curtiss P-40s during February 14–15, 1943. Note the distinctive "Indian's head" motif on the fuselage aft of the cockpit. Artwork by JUANITA FRANZI / AERO ILLUSTRATIONS © 2020

EN ARCHIVE

ABOVE ***All three Gruppen and the Stab of Bf 109G-2-equipped JG 77 had transferred from the Eastern Front to the Mediterranean theatre of operations from the summer of 1942. For desert operations, the Bf 109G-2/Trop was fitted with a sand filter for the Daimler-Benz DB 605 engine's supercharger intake, and other minor modifications.***

mayhem, strafing and destroying four Allied vehicles. The Luftwaffe attacks were unrelenting, as III./SKG 10 sent out a pair of missions at 1115hr and 1202hr, both led by highly experienced pilots against tanks and retreating Allied personnel and vehicles. The Fw 190 pilots noted that the Americans were now fleeing from Sidi Bou Zid. It was the perfect target for them, and, with light anti-aircraft fire the only opposition, they performed successful strafing attacks after releasing their bombs. These noon attacks struck just as Combat Command A started to withdraw its artillery units and command post from Sidi Bou Zid, and were effective in robbing that formation of communication with its subordinate units for the next few hours.

At 1230hr the P-39s were sent to the main battle area for the first time, accompanied by the 31st FG's 309th FS. No enemy aircraft were sighted, but three of the 81st FG's 92nd FS P-39s were damaged by anti-aircraft fire. Lieutenant Richard F. Carter was wounded in the left arm, and was subsequently recommended for the Distinguished Flying Cross. The citation read:

"Flying at a height of approximately 10ft [3m], Lt Carter's plane was struck in the left wing, near the cockpit, by a 40mm high-explosive shell. The wing was partly torn from the fuselage, rendering [the] aileron and instruments useless. Fragments of the shell penetrated the cockpit, inflicting severe wounds on his left arm, necessitating hospitalisation after return to base.

"Despite these handicaps, he continued firing on the enemy. On the return trip, he became separated from his flight and was unable to fly above 100ft [30m]. He managed, however, to bring his 'plane home without further damage."

At 1345hr Kampfgruppe Stenkhoff of the 21. Panzer-Division began pushing towards Sidi Bou Zid from the south-west, threatening to cut off American troops still near the village. By then, Combat Command A's command post was well to the west of Sidi Bou Zid, and a new defensive line had been established at a crossroads 11 miles (17km) west-north-west of the village, on the road to Sbeitla. This would allow withdrawing elements of Combat Command A to rally and reorganise. By 1530hr the German army commander felt he had achieved his mission, although the djebels still needed to be mopped up, and Sidi Bou Zid was not yet fully secured.

THE GERMANS CONTINUE TO PRESS

Meanwhile, the American retreat continued, and had now reached the Zaafria area, where it received yet more harassment from the ever-present Ju 87s and fighter-bombers. A force of 15 Stukas attacked motor transport near Zaafria between 1230hr and 1415hr, claiming great success. Around this time, Combat Command A reported the destruction of the 2nd Battalion, 17th Field Artillery Regiment by tanks and Stukas, the unit losing nine of its dozen 105mm guns.[9]

A pair of missions was also flown by III./SKG 10 to Zaafria between 1345hr and 1550hr, while six more Stukas were airborne from 1430hr to 1545hr. All German pilots reported hits on the target, with minimal resistance encountered from

Sporting the stars and stripes of the American flag as well as the standard star roundel with yellow border worn by USAAF Spitfires in North Africa, Mk VB (Trop) WZ-H, possibly ER926, of the 309th FS, 31st FG, awaits another sortie in 1943. The tropicalisation of a Spitfire for desert use incorporated a cumbersome Vokes air filter for the carburettor air intake and modifications to the cowlings.

AUSBORN VIA VINCENT

the ground, and none from the air. The only loss was *Feldwebel* (Fw) Alois Gschwind in an Fw 190, the 29-year-old being killed when he accidentally touched the ground while strafing and crashed.

Later that afternoon two 31st FG missions were intercepted by German fighters. The first of these, led by the Group CO, Col Fred M. Dean, was an escort for four A-20s and four P-39s to the area south of Faid Pass, where the formation encountered III./SKG 10 and its escort fighters. The 81st FG P-39s were led by Lt-Col Richard P. Klocko (CO of the 350th FG, but attached to the 81st), and they strafed trucks and other targets. Unfortunately, Lt Wesley G. Bedrick of the 81st FG failed to return, cause unknown. The A-20s bombed and strafed trucks of the 21. Panzer-Division, but an A-20 blew up upon returning to base, probably owing to an unexploded bomb detonating when the pilot shook the aircraft in order to free the undercarriage. Meanwhile, the Spitfires of the 308th FS engaged in an inconclusive dogfight with the Luftwaffe fighters, with neither side managing to open fire, although Dean was satisfied that his unit had at least kept the enemy aircraft away from the bombers.

The second American mission to be intercepted by German fighters around this time was undertaken by 12 Spitfires of the 307th FS and four strafing 92nd FS P-39s to Hadjeb el Aioun, to the north of the main battle area and perilously close to II./JG 2's base at Kairouan. Major LaBreche's Spitfire pilots reported being attacked at 1,000ft (300m) by two Fw 190s, which came from below and astern and fired in short bursts, before they climbed away into the sun. None of the Spitfires managed to fire at the enemy, and one Spitfire

BELOW ***With its centreline bomb clasp empty, an Fw 190A of SKG 10 taxies in with the help of a groundcrew member perched on the wing. The third Gruppe of SKG 10 was formed in December 1942 with the renaming of* Zerstörergeschwader *unit III./ZG 2, which had originally arrived in North Africa with its Fw 190s in November 1942.***

EN ARCHIVE

JEAN-LOUIS ROBA COLLECTION VIA AUTHOR

AUSBORN VIA VINCENT

ABOVE LEFT Leutnant ***Erhard Jähnert flew more than 620 combat sorties with StG 3/SG 3 during the war and was involved in the fighting at Sidi Bou Zid on February 14, 1943.*** **ABOVE RIGHT** ***Lieutenant Len Brown of the 309th FS poses for a photograph beside Spitfire WZ-C. Brown flew two missions on February 14 as wingman to the unit's CO, Maj Harrison Thyng.***

was riddled with bullets, although the fortunate pilot managed to return to base safely.

The 31st FG account tallies well with II./JG 2 records, because the Germans noted that three Fw 190s intercepted the Americans at low altitude 18min after scrambling from Kairouan, and a pair of aces reported victories: Hptm Rudorffer his 63rd and Oblt Bühligen his 60th.

With the American retreat finally over, the Luftwaffe now had the task of bombing the enemy behind a reasonably stable defensive line. Thus the last two Fliegerkorps Tunis missions of the day, flown by III./SKG 10 and StG 3 between 1555hr and 1740hr, were against forces to the west and north-west of Sbeitla. Hauptmann Hanns-Jobst Hauenschild of 10./SKG 10 led his unit on his third mission of the day. With American defences re-established, Luftwaffe pilots reported encountering anti-aircraft fire of all calibres, in stark contrast to the situation just a few hours earlier. Eight Ju 87s of StG 3 targeted an anti-aircraft battery, but one aircraft experienced engine failure. The pilot later wrote:

"My heart almost stopped — I was still over enemy territory with no possibility to land. The landscape below me resembled an oversized ploughed field. The furrows were valleys, and the clods thrown up were mountain ranges. And all of that was overgrown with huge cacti. The vegetation was the size of a family house, and stood wildly and in large numbers in the area."[10]

Luck was with this Stuka crew, however; after a forced landing not far from the front line, they were eventually able to make their way back to friendly territory and their base at Mezzouna. Not long after the III./SKG 10 mission landed at Kairouan the Gruppe returned to Bizerte, concluding its very successful day.

The day was finished by XII ASC with two more missions, the first to the main battle area by the usual combination of 31st FG Spitfires, A-20s and P-39s, and the second by the 308th FS and 15 A-20s of the 47th BG to Maknassy and Sened. The Maknassy mission was flown around dusk, with sunset at 1758hr, as one of the A-20 pilots wrote in his diary:

"Took off at 1700hr and bombed Maknassy. Had several Spitfires for cover. Ran into a lot of groundfire and flak but not accurate. Got back just at dark."

Both of these late bombing operations were considered successful by the Americans, and ended the day's air actions for the Allies.

END OF PLAY ON DAY ONE

At 1705hr Kampfgruppe Stenkhoff met up with elements of 10. Panzer-Division west of Sidi Bou Zid, and the village was firmly in German hands by nightfall. The attack had been an overwhelming success, completed faster than anticipated by the Germans. Sidi Bou Zid was taken, Djebels Ksaïra and Lessouda were isolated and an extension of the offensive could now be considered. As Rommel summarised: "The bulk of the American force was destroyed and the remainder fled to the west". The American 1st Armored Division was left nursing a very bloody nose — Combat Command A reported the loss of 44 tanks, 59 half-tracks, 26 artillery pieces and at least 24 trucks, with personnel casualties of six killed, 22 wounded, and 134 missing. So ended a

SORTIES TO THE SIDI BOU ZID BATTLE AREA, FEBRUARY 14, 1943

MORE THAN HALF of the USAAF's XII Air Support Command sorties were to the peripheries of the battle (for example Maknassy, El Guettar, Sened and Fondouk). Only Fliegerkorps Tunis missions related to *Unternehmen Frühlingswind*, as the German operations at Sidi Bou Zid were designated, are included

	Aircraft			Personnel		
	Sorties	Lost	Damaged	Killed	PoW	Wounded
USAAF XII ASC	228	4	7	4	2	1
Fliegerkorps Tunis	289	3	1	1	—	—

very busy day for Fliegerkorps Tunis and XII Air Support Command.

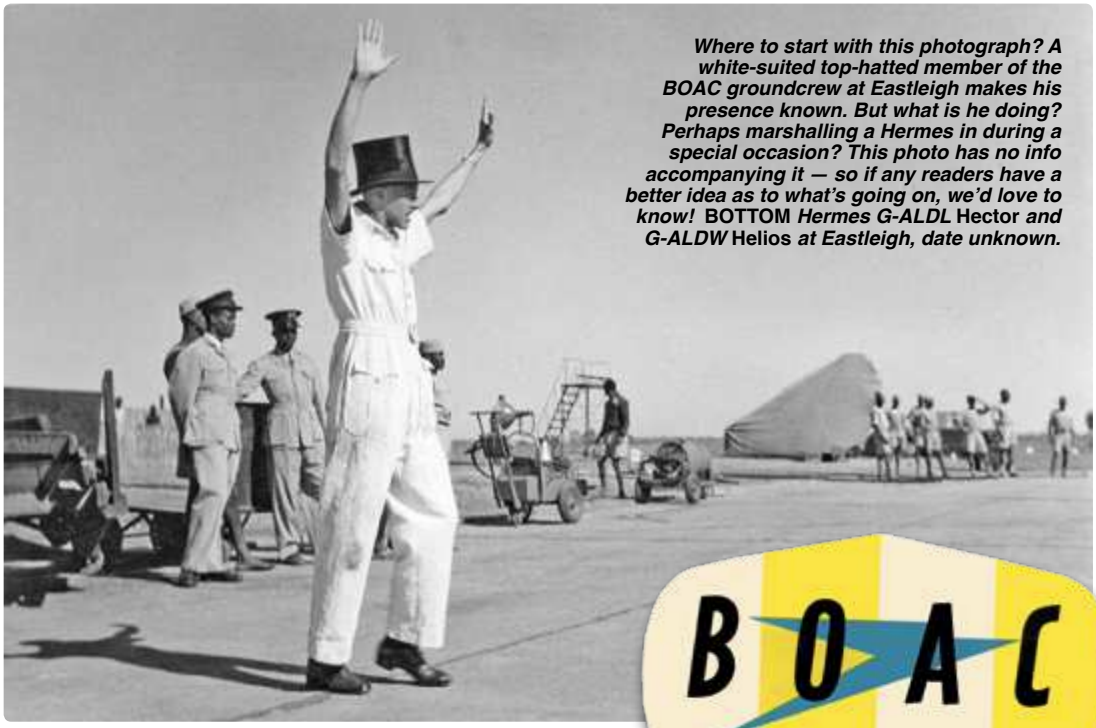
The Luftwaffe had contributed significantly to the German victory, and, although relatively few Stukas and fighter-bombers were committed, they exerted considerable influence over events on the ground that day. That evening, Fliegerkorps Tunis proudly reported to *Luftflotte 2* on the "most effective air support" provided in the successful attack on Sidi Bou Zid, classing Allied air activity against the German offensive simply as "slight".

Only during the evening of February 14–15 did the Allies begin to comprehend the seriousness and scale of what had befallen them. Nevertheless, all that British First Army commander Lt-Gen Kenneth Anderson agreed to was to release a medium-tank battalion from American Combat Command B to join Combat Command C for a planned counterattack the next day.[11] At Thelepte, American airmen could hear the withdrawing tanks and trucks going by. One 47th BG pilot noted in his diary: "Germans seem to be kicking hell out of us in general on this front". On the Axis side, Rommel urged the attacking force to push on through the night, but the commander at Sidi Bou Zid, *Generalleutnant* Ziegler, was content to wait for the inevitable American counterattack on February 15.

Neither side conducted any air operations on the night of February 14–15, but both were busy developing plans for the next day. XII ASC knew it needed to be more active, and to focus its efforts on the battle area. Other American air units were called upon for support. For Fliegerkorps Tunis, it was anticipated to be a case of "more of the same", with reconnaissance of the battle area a priority. The Fw 190s of III./SKG 10 were to transfer back south to Kairouan if needed, and, Thelepte having been identified as the major Allied tactical air force base, orders were passed for a mission to reduce its effectiveness.

1 With the exception of one long-range reconnaissance Staffel, 1.(F)/121
2 Thelepte was a very large airfield with two sections, Thelepte No 1 and Thelepte No 2
3 Initially the P-39s flew at low altitude and at normal cruise speed of 220–240 m.p.h. (354–386km/h), but this was changed, owing to heavy anti-aircraft fire, to maximum cruise speed; around 275 m.p.h (443km/h)
4 The pilot noted of the 37mm cannon: "Its rate of fire was pretty slow and we only carried 30 rounds. Still, when you hit something with it, it really made a dent"
5 Captain Frank A. Hill was in temporary command because Maj Avery was injured on February 10, 1943
6 A 1943 American analysis of operations in Tunisia noted: "It has been reported that even dive-bombing has failed to cause much damage to medium tanks"
7 There were definitely no P-38s present, so this was a case of misidentification. Throughout this series the reader will see pilots confuse Bf 109s with Fw 190s etc. The author has included the victory claims as recorded by those involved, even when they had clearly misidentified the type of aircraft they had met
8 Cannon-jamming owing to sand was a serious complaint for the 31st FG during February 14–15; Lt-Col Dean wrote about this in a report on early problems in North Africa: "Guns frequently clogged by sand. We now put canvas bags over tail end of cannon, toilet paper and cellophane paper over muzzles, and on machine-guns we now use canvas over front and fire through it. This helps but does not solve problem. It just helps to keep guns from being ruined permanently! Guns get daily inspection"
9 Unit veterans maintain that the Stukas disrupted their retreat, but caused little actual damage. Other American records, such as the Operations Report of Combat Command A, suggest the dive-bombers were at least partly responsible for the unit's demise
10 Jähnert, Erhard, *Mit dem Stukageschwader 3 an der Ostfront: Mal oben – mal unten, Teil II: 1943–1945*, Flechsig Verlag, Würzburg, 2010, p253
11 Fearing that this was only a feint owing to over-reliance on a decoded ULTRA signal suggesting the real attack would occur further north, Anderson refused to release all of Combat Command B, despite pleas from his subordinates

BELOW ***A typically busy scene at Youks-les-Bains on the Algeria–Tunisia border. The airfield was a vital base of operations for the US Twelfth Air Force against the German*** **Afrikakorps.** O'BOYLE VIA AUTHOR



Where to start with this photograph? A white-suited top-hatted member of the BOAC groundcrew at Eastleigh makes his presence known. But what is he doing? Perhaps marshalling a Hermes in during a special occasion? This photo has no info accompanying it — so if any readers have a better idea as to what's going on, we'd love to know! **BOTTOM** ***Hermes G-ALDL*** **Hector** ***and G-ALDW*** **Helios** ***at Eastleigh, date unknown.***

MAD DOGS & ENGLISHMEN

To East Africa by BOAC Handley Page Hermes

While looking through the *TAH* photographic archive recently, we found a handful of photographs evidently taken by a passenger or BOAC crew member at Eastleigh Airport in Nairobi, Kenya, during a Handley Page Hermes IV service to East Africa. There is very little information accompanying the images — but some show some rather intriguing activities!

ABOVE ***A member of BOAC groundcrew takes the weight off while awaiting the arrival of the next Hermes at Eastleigh. The Bristol Hercules sleeve-valve-engined Hermes IV replaced Short Solent flying-boats on the airline's East African services from September 1950, operating four times weekly to Nairobi via Rome, Cairo and Khartoum.***

ABOVE ***A November 1950 BOAC World Air Routes timetable.*** **LEFT** ***A handwritten caption on the back of this photo states that this "18-year-old police boy from the Maasai tribe . . . is quite average in height" and that "the ivory ball on his chin denotes that he has killed an elephant".***

HEINKEL'S LAST FIGHTER

A HOMEGROWN COLD WAR INTERCEPTOR FOR WEST GERMANY: THE HE 31

West Germany's acquisition of the Lockheed F-104G Starfighter as part of the "Deal of the Century" in the late 1950s is well known; what is not is the newly forged Federal Republic's attempts to kickstart an indigenous military aerospace industry with the development of a supersonic high-altitude interceptor of its own — as **TONY BUTTLER AMRAeS** relates

MUCH HAS BEEN written about the German aircraft industry's remarkable achievements before and during the Second World War, but it often gets forgotten that the nation's aircraft designers have continued to create new and advanced designs ever since.

During the 1950s and 1960s considerable effort went into German VTOL (vertical take-off and landing) fighter studies, eventually culminating in the flight-testing of two types of prototype — the EWR VJ101 in the 1960s *[See Andreas Zeitler's* We Wanted To Do Something Different . . . *in* TAH9 *— Ed.]* and the VFW VAK 191B in the 1970s. However, there were also efforts to create a conventional supersonic interceptor. One such example was the Heinkel He 31 *Florett* (Foil — as in the sword used in fencing). It is not well known overseas that this project was a serious attempt by West Germany to develop a new fighter/interceptor of its own rather than having to buy from a foreign country. The effort ultimately failed, however, and the nation finally settled on the USA's Lockheed F-104 Starfighter.

Designed during 1956–57 as a bespoke weapons system for the air defence of the Federal Republic

ABOVE ***What might have been? This specially commissioned artwork by MARK HARRIS shows a pair of He 31 Floretts climbing to intercept high-flying enemy aircraft after its prospective entry into Luftwaffe service in 1962–63. For more information on the illustration work of Mark Harris, visit www.markharris.ca. © MARK HARRIS 2020***

of Germany (West Germany), the He 31 would ultimately progress only as far as the planning stage. Instead, the *Bundeswehr* (West German Armed Forces) would buy the F-104G, in part because West Germany was still restricted in terms of what defence equipment it could procure, and also because its domestic aviation industry was still far from being adequately equipped to undertake the development and construction of a new cutting-edge combat aircraft. Nevertheless, the concepts of the He 31 and its competitor, the Messerschmitt P.1211, present powerful evidence of the creativity then still extant within the German aircraft industry.

This article was originally written by German aviation historian Wolfgang Mühlbauer and, as *Heinkel's letzter Jäger*, was published in German-language historical magazine *Flugzeug Classic* in its December 2007 issue. Wolfgang has kindly given permission to have his work translated and adapted for *TAH*.

A HOMEGROWN FIGHTER

Two related conferences held in London and Paris in September and October 1954 formally established the future status of West Germany. These conferences were organised after the Soviet Union had taken steps to give the German Democratic Republic (East Germany) a degree of legitimacy as a separate state. The outcome of the two conferences was the ratification of the Paris Agreements (aka Paris Accords) on May 5, 1955, which brought to an end to the military occupation of West Germany. The country was granted full sovereignty and permitted to join Nato, which allowed the nation to return to the design and development of military aircraft. This was important because according to many experts, industrialists and politicians, the establishment of a new technologically advanced industry could be achieved only by building military types; the civilian market alone offered little prospect of furnishing a profitable aircraft development and production capability for the future.

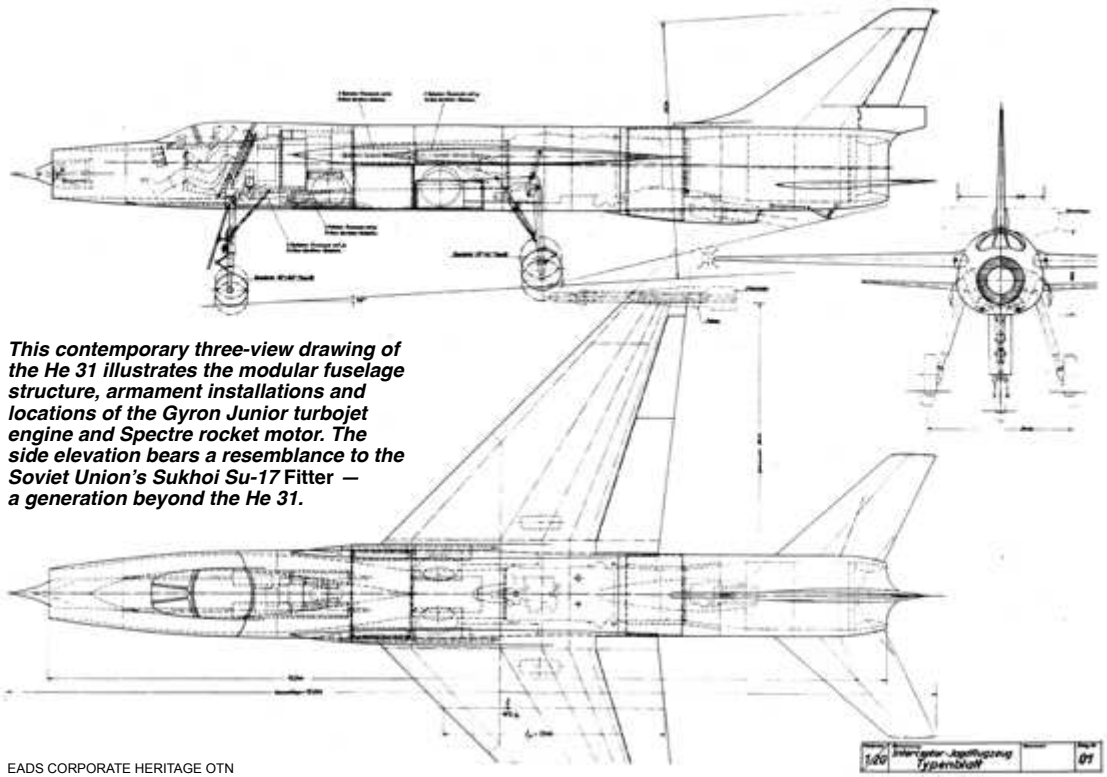
At this point contemporary Luftwaffe equipment — consisting mostly of a mix of obsolete and often donated aircraft, plus the licensed manufacture of more modern types — was at best suitable only for training. None of the aircraft on strength were suited to meet the nation's true defence needs, so their replacement by modern equipment required attention as a matter of urgency. The Luftwaffe and West Germany's aircraft industry had started to co-operate with other countries, as this provided basic technological know-how and experience in producing modern military aircraft and, above all, work for German companies. The desired breakthrough towards economic and technical

ABOVE ***At the end of the Second World War Josef Kammhuber, who had masterminded the Luftwaffe's wartime nightfighter defence system, was taken into custody by the USA, but was released without any charges in April 1948. After a spell in Argentina establishing a training programme for the nation's air force, he returned to Germany to join the Luftwaffe.***

independence, however, could only be achieved with the deployment of new prototypes of state-of-the-art designs.

This was not the only reason why the realisation of an independently developed high-performance combat aircraft seemed attractive. The particular geographical location of the Federal Republic required extremely short reaction times for air defence, and thus specialised weapons systems, which at the time did not exist. Accordingly, representatives of the *Bundesministerium der Verteidigung* (BMVg — Federal Ministry of Defence), including *Generals* A.D. Vorwald and Josef Kammhuber, explored the possibilities for their own industry in the so-called Koberner aviation talks held in 1956. Both had previously reached high office in Germany's wartime Luftwaffe, and in June 1957 Kammhuber became the new air arm's first *Inspekteur der Luftwaffe* (Commander of the Air Force), having organised Germany's wartime nightfighting units.

First priority at the talks were the problems of the nation's air defences, followed by equipment and development issues. A lightweight high-performance interceptor quickly became a central



This contemporary three-view drawing of the He 31 illustrates the modular fuselage structure, armament installations and locations of the Gyron Junior turbojet engine and Spectre rocket motor. The side elevation bears a resemblance to the Soviet Union's Sukhoi Su-17* Fitter *— a generation beyond the He 31.

EADS CORPORATE HERITAGE OTN

component of the discussions. It was agreed that a powerful air force could only be based on the latest airframe and engine technology, although Kammhuber declared that "the world market today offers nothing that would be useful for German standards". Designs such as the North American F-100 Super Sabre and F-104 Starfighter were "of no interest to us" because of the long runways these fighters required. However, sections of the Luftwaffe's command staff had long been interested in the extremely powerful F-104, while parts of the West German government were already thinking about the first (forced) mergers within the aviation industry, in order to bring together its limited capacities for the licensed production of modern aircraft such as the F-104 (and thus accelerate the hoped-for boost in technical knowledge and capability). In addition, there were various other external political objectives which would not allow room for technical in-house aircraft developments.

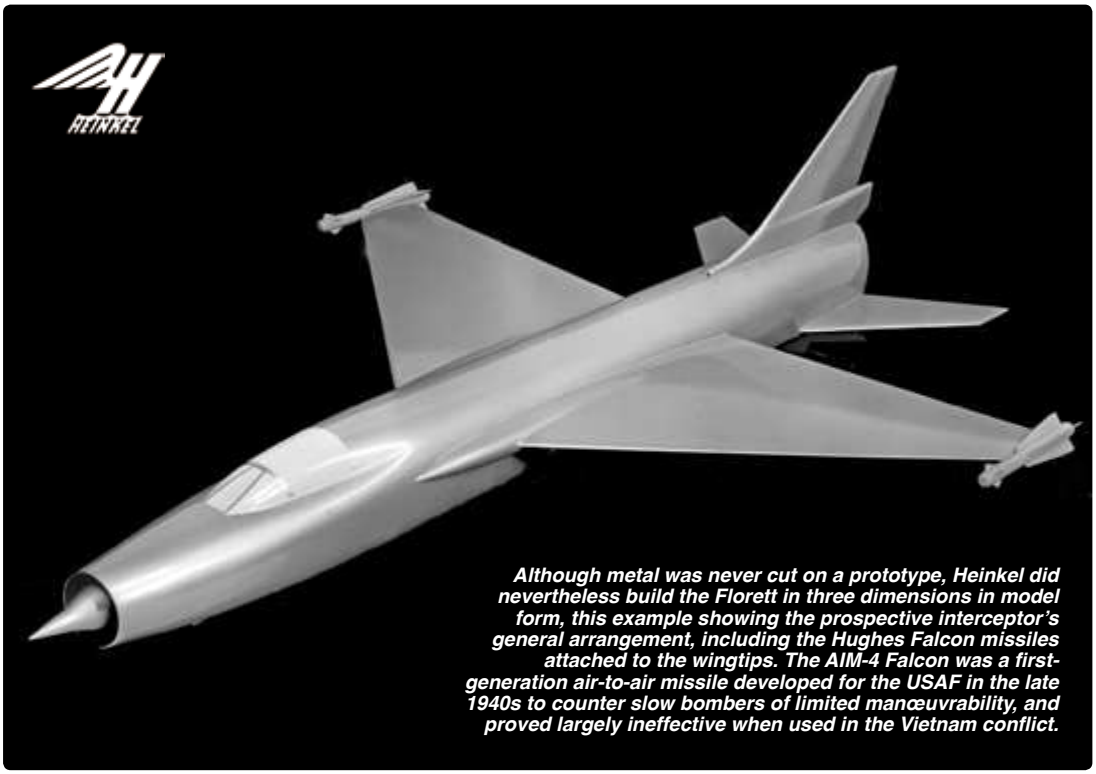
Considering his country's experiences of the then-still-recent war, Kammhuber unreservedly supported industrial integration, but at the same time remained an advocate of producing indigenous aircraft designs and programmes. Immediately after taking office he ordered a halt to the ordering of new interceptor-type aircraft from overseas. One outcome of the Koberner talks was a "Design Competition for the Development of Interceptors", as requested by the BMVg, but only those companies the latter deemed to have suitably qualified staff and relevant experience would be considered.

On November 15, 1956, invitations to participate were sent to Dornier, Messerschmitt, Heinkel and the design office of Professor Walter Blume. (The last-named, the former design engineer and Director General of Arado Flugzeugwerke, had played a major wartime role in the development of the Arado 234 jet bomber. In October 1952 he opened the Büro Blume — official name *Leichtbau und Flugzeug GmbH* — in Duisburg, where, together with several employees, he designed the four-seat Blume Bl 500 light aircraft. Plans to put the Bl 500 into production came to nothing and in September 1955, under pressure from the West German government, Blume joined Focke-Wulf.)

The designated judges were to be lecturers from the Technical Universities of Darmstadt, Aachen and Berlin. Each participant was requested to submit a draft design, possibly with different versions, along with data, to include extensive weight and performance calculations, a schedule for the development programme up until the first flight and a review of the costs involved.

A DEMANDING SPECIFICATION

The specified performance parameters for the prospective aircraft were a maximum speed of Mach 2, a service ceiling of 25,000m (82,000ft) and a rate of climb that would get the aircraft to that height in less than 3min. The maximum take-off distance for the aircraft to clear a 15m (50ft)



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Although metal was never cut on a prototype, Heinkel did nevertheless build the Florett in three dimensions in model form, this example showing the prospective interceptor's general arrangement, including the Hughes Falcon missiles attached to the wingtips. The AIM-4 Falcon was a first-generation air-to-air missile developed for the USAF in the late 1940s to counter slow bombers of limited manœuvrability, and proved largely ineffective when used in the Vietnam conflict.

obstacle had to be less than 1,000m (3,300ft). The armament was specified as two air-to-air guided missiles and a battery of unguided 2in (50mm)-diameter rocket projectiles. The navigation and electronic equipment was to include a radar with a range of 30–50km (20–30 miles), an IFF (Identification, Friend or Foe) system and a TACAN (Tactical Air Navigation) radio navigation aid.

The choice of powerplant would prove to be a somewhat delicate point. Since no new German jet engine was available, an existing foreign type had to be used, the final choice coming down to the British de Havilland Gyron Junior PS.50 (which eventually powered the Bristol 188 supersonic research aircraft). However, in order to be certain that the required speed performance could be achieved, an additional de Havilland Spectre rocket motor was also suggested.

In the event, Dornier did not take part in the competition, Messerschmitt offered its twin-engined P.1211 design (of which more shortly), and Blume's contribution is unfortunately not available. Heinkel's design department, headed by Siegfried Günter, set itself the target of exceeding the required performance, and, thanks to previous study assignments including the He 11, He 12 and He 21 fighter designs, the conditions were promising. (The He 11 and He 12 were small delta-wing fighter designs produced in 1956 for Egypt and Spain respectively.)

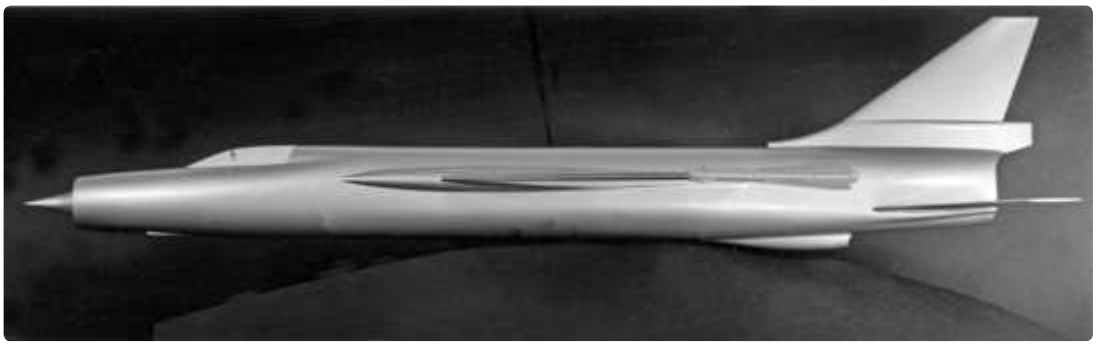
By the beginning of January 1957 the He 31's design had largely been frozen. Günter considered that it had the lowest possible development risk, but he did expect some resistance from certain sides of the industry which were only interested in lucrative deals to manufacture overseas aircraft under licence.

THE HEINKEL DESIGN

The He 31 (the name Florett was bestowed later) was a single-engined design with "delta-like" trapezoidal wings and swept tail surfaces. The open-nose air inlet contained an adjustable shock-cone, inside which was housed the radar scanner. The fuselage comprised three separate assemblies, the first front section including the cockpit and nose undercarriage. Housed in the middle section were the Gyron Junior engine, the main undercarriage and four snug-fitting integral fuel tanks containing 900lit (198gal) of kerosene, plus two further aluminium tanks holding a total of 530lit (117gal) of hydrogen peroxide for the rocket motor. The mainwheels (designed for take-off and landing on grass runways) would swivel during retraction to save space inside the airframe. The Spectre rocket motor was located in the rear fuselage beneath the afterburner system, another 470lit (103gal) hydrogen-peroxide tank and another 200lit (44gal) kerosene tank.

The three-spar wing, swept at 45° on the leading edge, could be removed for transport and incorporated ailerons and flaps which were to be "blown", using engine-bleed air, and contained

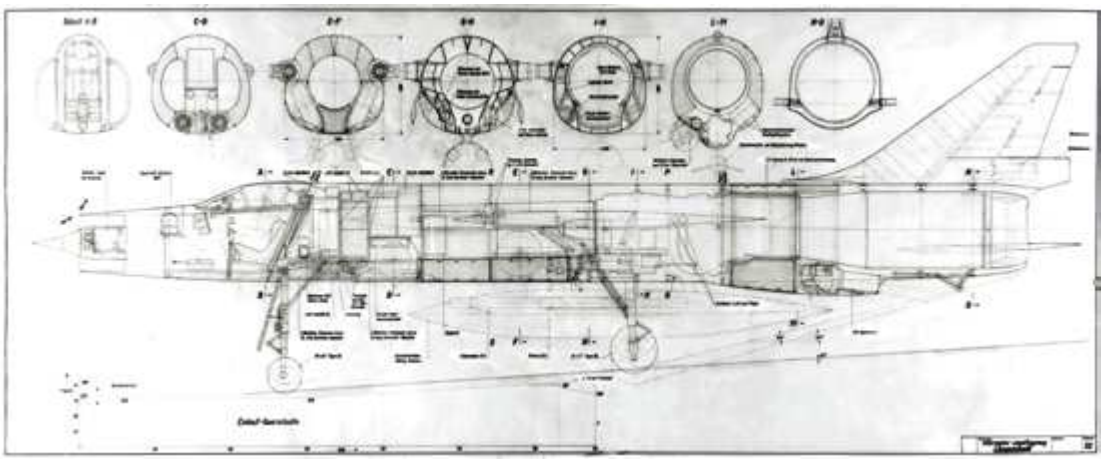
Three more views of the manufacturer's model show plan, side and head-on views of the He 31. In the plan view it resembles a larger MiG-21 with more of a trapezoidal wing than the pronounced delta configuration of the Soviet fighter's wing, although both incorporated a separate all-flying tailplane or "stabilator" for improved control at high speeds.



ABOVE *The side view emphasises the sleek lines of the design, interrupted on the underside of the fuselage only by the fairing for the de Havilland Spectre rocket motor. The latter was a bipropellant engine which used kerosene and hydrogen peroxide as fuel, and which could provide variable power from 10–100 per cent up to 8,000lb-thrust.*

EADS CORPORATE HERITAGE OTN x 3

ABOVE *The head-on view shows the nose air-intake, within which sits the adjustable shockcone. The proposed single de Havilland (later Bristol Siddeley) Gyron Junior engine was to be a variant of the PS.50 (aka DGJ.10) version of the engine used on the Bristol 188, capable of 10,000lb-thrust dry and 14,000lb-thrust with afterburner.*



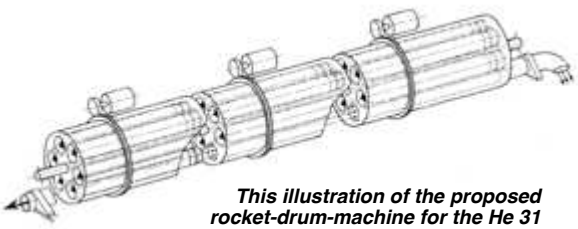
ABOVE ***A technical drawing of Heinkel's "Interceptor-Jagdflugzeug" (interceptor fighter) showing sections. The He 31 was designed by Siegfried Günter after the prolific designer's return to the company following his arrival in West Germany in 1956, having spent the immediate post-war period designing aircraft in the Soviet Union and living in East Germany during 1954–56.*** EADS CORPORATE HERITAGE OTN x 2

yet another 550lit (121gal) integral tank, almost certainly for kerosene. The tailplane was swept to an angle of 50° at the leading edge and did not incorporate separate elevators; this was an all-moving surface on self-supporting axles and was operated hydraulically. The fin was swept to an angle of 45° and incorporated a separate rudder; the base of the fin was thickened slightly to accommodate the landing brake-parachute and brake flaps.

The design process followed the principle of "maximum aerodynamic safety and the easy replacement of all components", and both the cross-section area and maximum fuselage diameter were determined by the size of the engine. The new theory of "area ruling" was considered, but up until that point it had been verified only for relatively thick fuselages, and it was uncertain whether a corresponding thickening of the He 31's fuselage would lead to a reduction in drag. However, should it be applied to the He 31, it was felt that the modification would not give any problems with the aircraft's structure.

The mid-fuselage engine arrangement promised further reductions in drag and, in order to ensure the required performance at altitude, the choice had been made to make the wing reasonably large. Heinkel was familiar with the advantages — and problems — of designing a pure-delta wing and had consequently given the He 31 a tailplane to improve rudder effectiveness, especially when flying supersonically at high altitude. In addition, the use of blown flaps would not have been possible without a tailplane. However, Heinkel emphasised that the He 31's final aerodynamic shape could only be determined following a detailed assessment in a windtunnel. Much of that, however, would have to be performed abroad, although the results were not expected to produce any "fundamental changes to the design".

The call for tenders had also required the consideration of a detachable cockpit for use in an emergency, but Heinkel considered that this

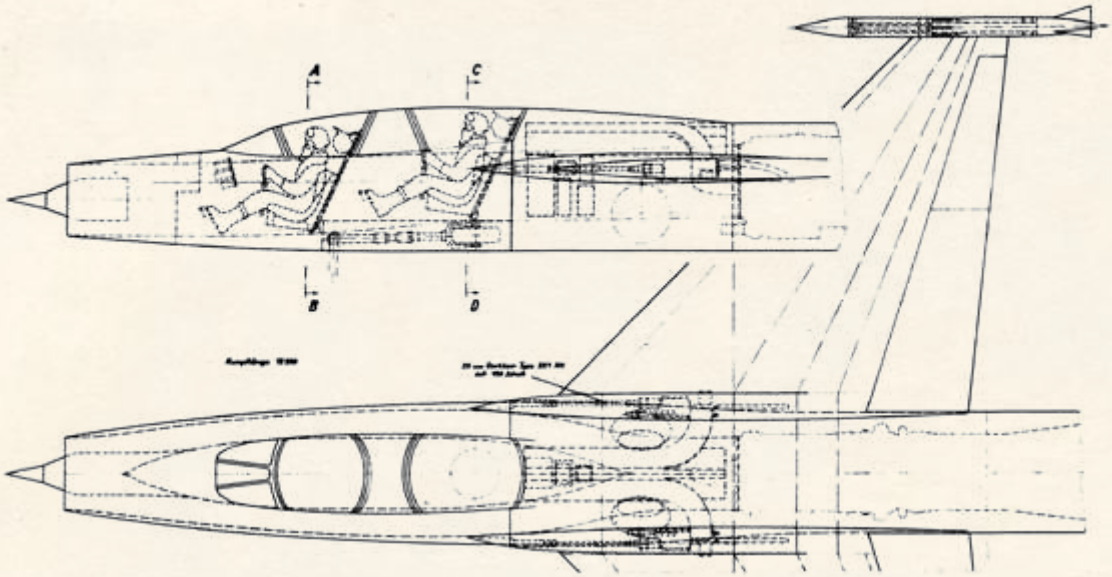


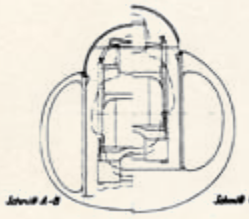
This illustration of the proposed rocket-drum-machine for the He 31 appears to show a modified version, with three drums rather than two, the first having six rockets and the other two five, the latter each having one chamber empty to permit the exhaust gases to escape.

item's development and testing would be "time-consuming and difficult". The stabilisation of the cockpit section, which would take much longer to depart from a stricken airframe than would an ejection-seat, seemed particularly problematic, and it was soon clear that a modern ejection-seat, in combination with a suitable pilot's pressure suit, would suffice.

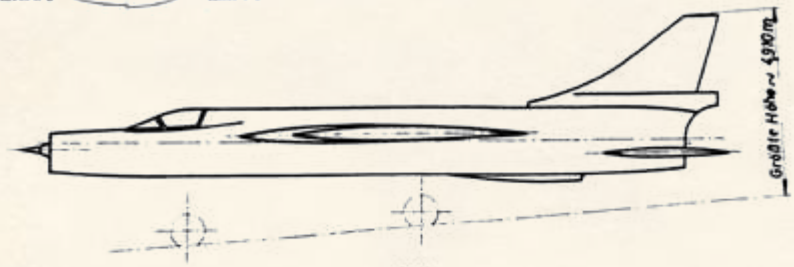
THE ARMAMENT

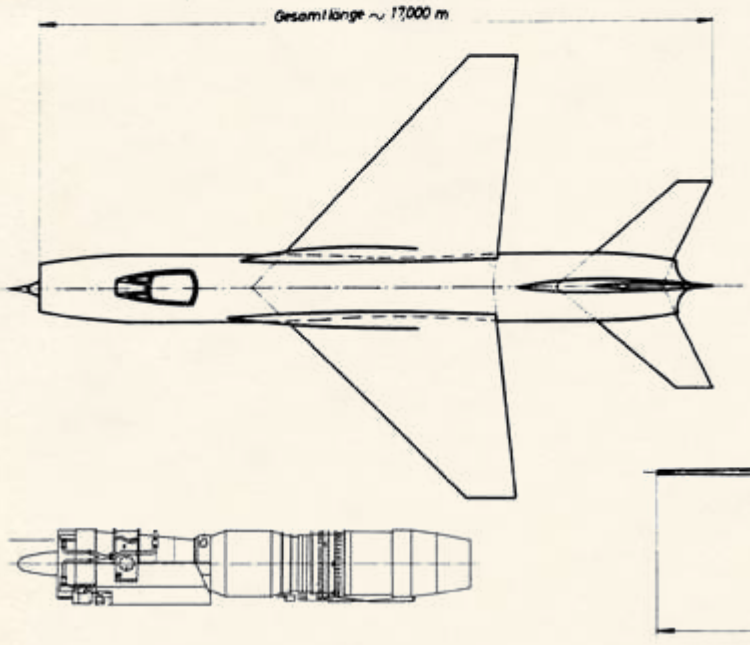
An American Hughes Falcon air-to-air missile was to be attached to each wingtip. The true speciality of the He 31, however, was its rocket-drum machine, which enabled unguided rocket projectiles to be carried in a way that saved space. Patent pending, the rocket-drum machine was based on a simple principle. Two drums arranged on a single axis were connected by a common launch tube. While all the chambers of the first drum were loaded (eight in all), a single chamber of the second drum, behind the firing chamber of the first drum, was left empty. This would allow the missile's exhaust gases to escape from the first drum through the empty chamber of the second, and the missiles of the first drum would then





ABOVE & LEFT ***A two-seat trainer version of the He 31 was also proposed, and would have carried a reduced armament. Note that on retraction of the undercarriage the nosewheel would rotate through 90° to enable the wheel to lie flat beneath the second cockpit. The latter was raised slightly higher than the front cockpit, but would have offered somewhat limited visibility for the instructor.*** EADS CORPORATE HERITAGE OTN





LEFT & BELOW ***Apparently for internal (company) comparison purposes only, this "Florett B" design was examined in the autumn of 1957. It was to be powered by a Canadian-built Orenda Iroquois jet engine*** **(BELOW, FAR LEFT)** ***but was to retain the rocket motor. A somewhat larger aircraft, this had a span of 11·10m (36ft 5in), a length of 17m (55ft 9¼in) and a height of 4·910m (16ft 1⅛in). The plan view appears to show two different wing sizes (the starboard is larger), although this may be a distortion in the drawing. The fuselage also appears to be area-ruled.***

EADS CORPORATE HERITAGE OTN

HEINKEL He 31 DATA

Powerplant 1 x de Havilland Gyron Junior PS.50 turbojet of 10,000lb (4,535kg)-thrust dry, 14,000lb (6,350kg)-thrust with afterburner, plus 1 x 4,400lb (1,995kg)-thrust de Havilland Spectre rocket motor

Dimensions

Span	8·64m	(28ft 4in)
Length	13·85m	(45ft 5¾in)
Height	3·87m	(12ft 8⅛in)
Gross wing area	24·9m²	(267·74ft²)

Weights

Maximum take-off	7,980kg	(17,593lb)

Performance (estimated)

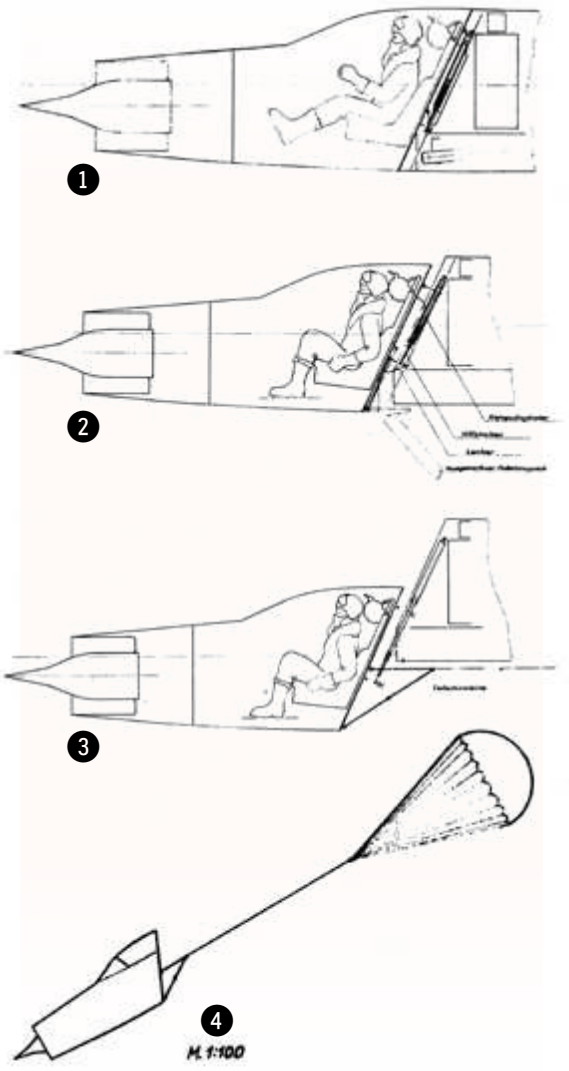
Maximum level speed	Mach 2·6 at 18,000m (59,000ft)	
Service ceiling	30,000m	(98,000ft)
Maximum range	2,600km	(1,600 miles)

Armament

2 x air-to-air missiles; 60 x 50mm (2in) Oerlikon unguided rocket projectiles

all be fired during a gradual rotation while the second drum remained static. On completion the first drum would be locked and the seven missiles in the second could be fired. Each installation thus carried 15 rocket projectiles. Four of these weapons in all were to be carried, one in each wing root and two in the lower forward fuselage beneath and to the rear of the cockpit.

In terms of performance, it was estimated that the He 31 could reach its required speed of at least Mach 2 and ceiling of 25,000m even without using the rocket engine — this would be used primarily to increase the performance at high altitude only. For air combat it offered hardly any advantages. Indeed, it made more sense to omit the rocket engine completely and instead include more kerosene to increase the range.



EADS CORPORATE HERITAGE OTN

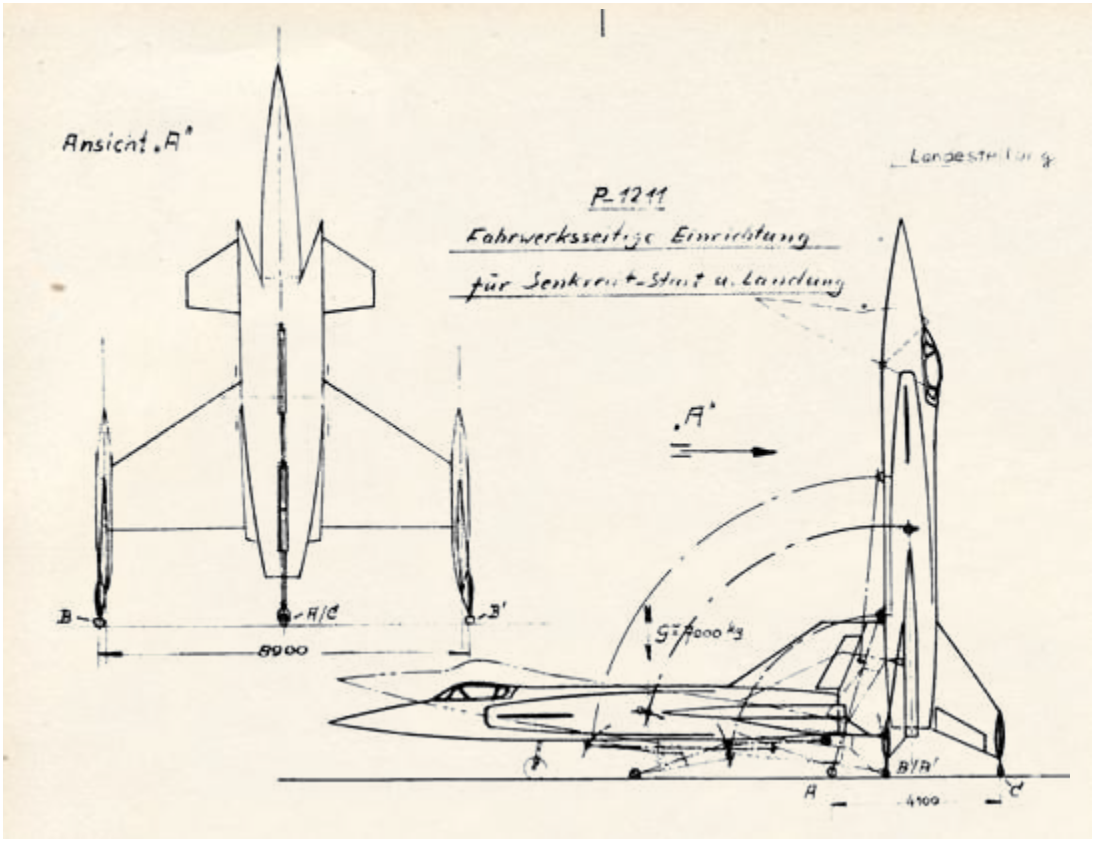
ABOVE ***A detachable nose section was explored, the four-stage detachment sequence of which is seen here: 1 = nose and cockpit in normal flight; 2 & 3 = detachment of nose. The small print denotes, in descending order, the catapult cylinder, auxiliary piston, "handlebar" and ejected parachute pack. Number 4 shows the whole nose section descending by parachute with limiting detachment speed of Mach 1·1.***

THE WINNING LOSER

The plan was to build four V-type prototypes (V for *Versuchs* — Experimental) and the first flight was expected to take place 36 months after the start of development. Entry into Luftwaffe service was expected to follow during 1962–63 after the completion of the aircraft's factory and official testing. The estimated cost of the whole programme was calculated to be DM48m, including the windtunnel testing abroad.

In July 1957 the He 31 Florett was selected as the winning design, but neither economically nor politically was there any prospect of the project ever proceeding. From the beginning, the F-104 had hung like a "Sword of Damocles" over the design competition, and it was used constantly for comparison purposes. It seemed almost as if the competition had been held only with a view to discovering the capabilities of the West German aviation industry at this time, and perhaps also as a small decision-making aid. Officially, the desire was to identify and acquire the most efficient weapons system (from a technical point of view) that appeared to be readily available, and the choice fell on the F-104 Starfighter.

The most important competing project against the He 31 was the P.1211 from Messerschmitt. This design's configuration, including reverse-sweep air intakes and a thrust reverser, was quite unusual. Unfortunately, only a few details of its predicted performance have survived, along with hardly any detailed information about how the project progressed. In addition to, once again, a de Havilland Gyron Junior turbojet, the P.1211 was to be fitted with two liquid-fuel rocket motors,



EADS CORPORATE HERITAGE

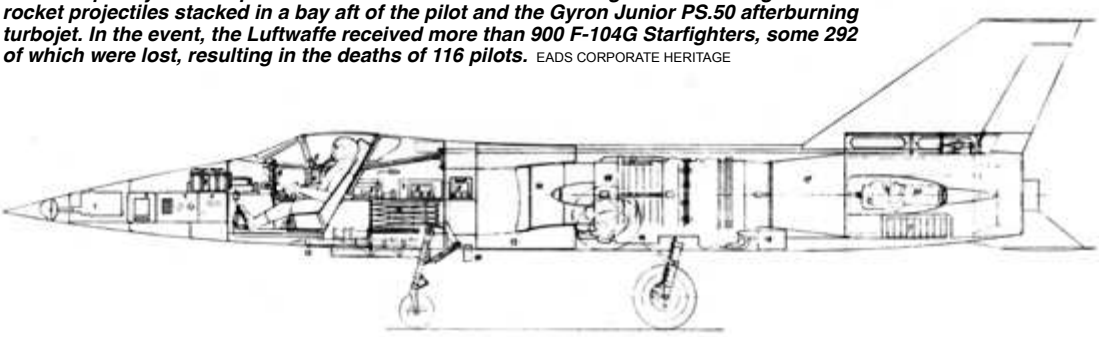
ABOVE ***This sketch dated February 12, 1957, shows the unusual delta + canard configuration of the Messerschmitt P.1211 and the* "Fahrwerksseitige Einrichtung für Senkrecht-Start und Landung" *— Undercarriage Equipment for Vertical Take-off and Landing. The nose section appears to be articulated, perhaps for ease of entry and egress.***

attached to the sides of the rear fuselage. Variants without these additional rocket units were also planned and the take-off weights of the individual designs ranged from 6,800kg (14,990lb) to 7,800kg (17,200lb). The estimated maximum speed was Mach 2·8 and service ceiling 34,000m (111,600ft). The proposed idea of the P.1211 making a vertical take-off with the help of swivelling struts seems particularly interesting but, unfortunately, no further information appears to be available beyond the drawings seen here.

The P.1211's armament comprised rocket projectiles stored in a fuselage bay to the rear of the cockpit, which would be fired through two twin fairings underneath the cockpit sides, plus two Falcon air-to-air missiles, one mounted on each wingtip fairing, quite unusually on top of the forward section. The single Gyron Junior was to be fed with air by large side intakes. The P.1211's span was 9m (29ft 6in), length approximately 12·95m (42ft 6in) and height 3·69m (12ft 1⅓ in). Sadly, little more is known about it.

ACKNOWLEDGMENTS *The author would like to thank Wolfgang Mühlbauer for the opportunity to adapt his original German-language text for this article*

A contemporary inboard profile illustration of the P.1211 showing detail including the rocket projectiles stacked in a bay aft of the pilot and the Gyron Junior PS.50 afterburning turbojet. In the event, the Luftwaffe received more than 900 F-104G Starfighters, some 292 of which were lost, resulting in the deaths of 116 pilots. EADS CORPORATE HERITAGE



THE SHAH'S JETSTARS

THE LOCKHEED 1329 JETSTAR IN IRANIAN SERVICE

Earlier this year the Islamic Republic of Iran Air Force officially retired the last surviving example of its fleet of Lockheed JetStars, thus marking the end of the type's international military and governmental career. Iranian aviation historian **BABAK TAGHVAEE** describes the evolution of the sleek bizjet into a military transport and chronicles the type's career in Iran

IN JANUARY 2020 the world's last remaining Lockheed L-1329 JetStar on strength with a military air arm was officially withdrawn from service by the Islamic Republic of Iran Air Force (IRIAF). Some 42 of the total of 202 L-1329s produced by Lockheed during 1960–80 were used by the governments and air forces of 11 countries across the world. The Iranian government became the type's third foreign customer in 1962, and kept the aircraft in service for an impressive 58 years. Four examples of the JetStar were acquired by Iran, of which one crashed; one was sold in 1963 and two are in permanent storage at Mehrabad International Airport in Tehran.

A 'STAR IS BORN

By the mid-1950s the USAF was in need of a replacement type for its large fleet of largely wartime-vintage light utility/transport aircraft.

ABOVE ***The Islamic Republic of Iran Air Force's last operational JetStar, serial 5-9003, on finals into Mehrabad in March 2009. The IRIAF operated a total of four examples of the type in three variants. This aircraft, initially an Iraqi Airways machine, was appropriated by the IRIAF after having been flown to Iran to avoid the Gulf War in 1991.*** AUTHOR

PHILIP JARRETT COLLECTION

ABOVE ***CL-329 first prototype N329J (c/n 1001) made its maiden flight from the Lockheed Air Terminal at Burbank, California, on September 4, 1957, fitted with two Bristol Orpheus turbojets and minus the wing-mounted slipper tanks that became such a distinctive feature of production aircraft. This example survives at the Museum of Flight in Everett, Washington, USA.***

In response, Lockheed developed the CL-329 to meet the specifications of the USAF's Utility Transport Experimental (UCX) requirement for a light liaison and transport jet aircraft, to carry 14 passengers or 5,000lb (2,300kg) of cargo. However, owing to severe budget restrictions imposed on military spending in 1957, the USAF's plans to procure a UCX machine were cancelled, but development of the CL-329 project was continued by the manufacturer as a private venture. The first prototype, N329J, made its maiden flight on September 4, 1957, powered by a pair of British-built Bristol BOr. 3/5 Orpheus turbojet engines of 4,850lb (2,200kg)-thrust each.

Serial production of the aircraft began at Lockheed's factory at Marietta, Georgia, in November 1958, and the company's gamble appeared to have paid off when the USAF selected the type as a crew trainer — designated T-40A-LM — to fulfil its Utility Trainer Experimental (UTX) programme. A few months later the USAF's plans changed again and North American's smaller NA-246 Sabreliner — designated T-39 in USAF service — was selected as a cheaper option.

Owing to difficulties regarding production of the Orpheus engine under licence in the USA, Lockheed was forced to find an American replacement for the powerplant, with the Pratt & Whitney (P&W) JT12A turbojet ultimately being selected. As the latter was less powerful — 3,000lb (1,360kg)-thrust — Lockheed designed a twin-engine mounting, one on each side of the rear fuselage, to accommodate a total of four JT12A-6s, to create the definitive Model 1329 JetStar. The second prototype, N329K, was so modified and made its maiden flight with the new configuration in January 1960.

By the spring of 1960 Lockheed had received orders for the type from civilian operators and two from the Canadian government. The first production Model 1329, N9201R (c/n 5001), flew for the first time on October 21, 1960, and was delivered to the Federal Aviation Administration (FAA) with the registration N1, to be used to transport personnel.

AIR FORCE ONE (AND A HALF)

From c/n 5002, the next 60 production L-1329s were given the company designation JetStar 6, and were produced for the corporate market and domestic and foreign government agencies. These were followed by 66 JetStar 8s, fitted with more powerful 3,300lb (1,497kg)-thrust JT12A-8 turbojet engines.

In addition, 16 military examples, designated C-140s, were produced for the USAF. The first five of the latter, ordered in 1960 and fitted with P&W J60-P-5 engines, the military version of the JT12A-6, were designated C-140A-LMs with serials 59-5958 to 59-5962, and were delivered to the USAF's Air Force Communications Service (AFCS) from September 1961. With the establishment of the 1866th Facility Checking Flight (Service Evaluation) at Richards-Gebaur AFB, near Kansas City, Missouri, on July 1, 1962, the USAF started using these five aircraft for calibration of airport navigational aids such as ILS and NDB systems.

The USAF also ordered five C-140B-LM utility transport variants — serials 62-4197 to 62-4201 — which were equipped with a convertible cabin for easily switchable passenger and cargo configurations. Although these were ordered after the C-140A-LMs, they were delivered in April 1961, five months before the calibration aircraft entered sevice. In addition, six VIP-configured VC-140B-LMs were ordered, these

MIKE HOOKS

ABOVE ***The Canadian government was one of the first non-corporate operators of the JetStar 6, two being acquired by the Department of Transport in early 1962. Seen here at a Canadian airport in October 1966 is the second to be delivered, CF-DTF (c/n 5088), in a colour scheme that emphasises the type's rather purposeful lines.***

and the C-140Bs entering service with the 1254th Air Transport Wing, Special Air Mission, based at Andrews AFB in Maryland.

During April–June 1959 three Boeing 707-153s — designated VC-137As — were delivered to the USAF to become the first jet-powered aircraft to be used to transport the President of the USA. The VC-140Bs were used in combination with the VC-137As for Presidential duties, and later with their successors, a pair of VC-137Cs. In addition to the President, high-ranking government officials and other heads of state also used the six VC-140Bs for short trips, mostly within the USA. President Lyndon B. Johnson was a frequent user of the JetStars while serving as John F. Kennedy's Vice-President, and later when appointed President himself. Reportedly, Johnson nicknamed the VC-140B "Air Force One and a Half".

OVERSEAS SALES

On June 4, 1959, Indonesian President Sukarno visited Lockheed at Marietta as a prelude to placing an order for 11 C-130B Hercules for the *Tentara Nasional Indonesia-Angkatan Udara* (TNI-AU — Indonesian Air Force). While on site, he was also introduced to the JetStar 6, which was already in production there. As a result, Sukarno placed an order for one VIP aircraft. Accordingly, serial T-17845 (c/n 5011) was delivered to Indonesia in 1961 to replace Ilyushin Il-14P serial T-401, used as the Presidential aircraft by the TNI-AU's *Skuadron 17* at Jakarta.

Another two JetStar 6s — c/ns 5046 and 5059 — were ordered by the Indonesian government, and were delivered to the TNI-AU in 1964 and 1965 respectively. These two served as Presidential aircraft with serials T-9446 (later A-9446) and T-1645 (A-1645) respectively. The three JetStars were named *Irian* (T-17845), *Sapta Marga* (T-9446) and *Pantja Sila* (T-1645, later *Pancasilla)*. The last two were equipped with flare dispensers for protection against man-portable air-defence systems (MANPADS) during take-off and landing.

In 1961 Germany's Luftwaffe became the third military operator of the JetStar 6, when serial CA+101 (c/n 5025) became the first example in a fleet of three. The other two — CA+102 (c/n 5035) and CA+103 (c/n 5071) — were delivered in 1962 and 1965 respectively. After the loss of CA+102 on January 16, 1968, a replacement JetStar 8 was ordered, becoming serial 11+02; CA+101 and CA+103 were also reserialled 11+01 and 11+03 respectively, as part of a reorganisation process.

On April 24, 1962, His Imperial Majesty Mohammad-Reza Shah Pahlavi of Iran travelled to the USA and paid a visit to Lockheed at Marietta. Like Sukarno, he visited the C-130 production line and also saw the JetStar 6 production line. A keen pilot, the Shah flew the aircraft himself, and, impressed by the fact that the type had already proved its reliability and comfort in the President's Air Force One fleet, decided to proceed with an order.

THE JETSTAR IN IRAN

On October 10, 1962, Fokker F-27-100 EP-MRP, one of three VIP-configured aircraft in the Royal Fleet of the Imperial Iranian Air Force (IIAF), crashed in the Alborz mountains north-west of Tehran, during a ferry flight from Mehrabad International Airport to the port city of Nowshahr on the Caspian Sea, with the loss of all four crew. The demise of EP-MRP forced the Iranian government to find a quick solution to fill the

MIKE HOOKS

ABOVE ***The original EP-VRP (c/n 5002), acquired by the Shah of Iran in June 1963, is seen here in the summer of 1967 during a visit to Gatwick Airport in the UK.*** **BELOW RIGHT** ***The Shah inspects a JetStar at the Lockheed factory at Marietta, Georgia, in 1962. He liked what he saw and ordered a single example to be fitted to a VIP spec.***

resulting gap. As mentioned, the Shah had been impressed by the JetStar at Marietta and thus it was selected by the Iranian government as a readily available replacement for EP-MRP.

Rather than make the Shah wait for months to take delivery of his new aircraft, Lockheed offered him the second production JetStar 6, N9202R (c/n 5002), which the company had used for test and evaluation purposes. Accordingly, the aircraft was modified a with VIP interior to the specifications of the Shah and delivered to Iran by the Shah himself in June 1963 with the civil registration EP-VRP. Following the JetStar's delivery, Morane-Saulnier MS.760B Paris EP-HIM — the first jet in the IIAF's Royal Fleet — saw much-reduced service and was sold to a French customer in December 1966.

Shortly before EP-VRP was due for a major overhaul in 1969, the decision was made not to send the aircraft to the USA for maintenance. Instead, the Iranian government placed an order for a new JetStar 8 with the more powerful JT12A-8 turbojets. The new aircraft, c/n 5137, was delivered to the IIAF's Royal Hangar in 1969; the original JetStar 6 was subsequently sold to an American customer, after which the registration EP-VRP was re-allocated to the new machine.

Painted in a dark gunship-grey colour scheme, the second EP-VRP remained the Shah's sole VIP aircraft until 1974, when the Iranian government acquired Boeing 727-081 N329K (c/n 19557) — curiously, the same registration as the second JetStar prototype — previously owned by All Nippon Airways and the Ford Motor Company. The 727 was given the civil registration EP-MRP and named *Shahbaz* following its delivery to the Royal Hangar in June that year. The 727 quickly

became the Shah's primary VIP aircraft, especially once he had qualified on the type. The JetStar was thus largely relegated to domestic flights and trips to neighbouring countries.

The previous year, on August 29, 1973, the Iranian government had placed an order for the latest version, the JetStar II, to augment the Shah's Royal fleet. In addition to the US$3·5m contract for the new aircraft, the Shah also paid to have the cabin of EP-VRP upgraded to a similar standard to that of the newly acquired JetStar II, which was delivered in 1976 as EP-VLP.

The JetStar II was equipped with more powerful and fuel-efficient Garrett AiResearch TFE731-3 turbofan engines of 3,700lb (1,678kg)-thrust,

Unlike its identically registered predecessor, the second EP-VRP, JetStar 8 c/n 5137, was painted in a very austere overall dark gunship-grey scheme which robbed the aircraft of a great deal of its natural elegance. It is seen here taxying at Paris-Orly sometime during the early 1970s. The type's distinctive 565 US gal (2,140lit) wing-mounted slipper tanks were initially trialled on the second prototype and fitted to all production JetStar 6s and 8s. VIA AUTHOR

and had revised underwing fuel tanks of greater capacity than the JetStar 6/8's distinctive slipper tanks, thus considerably extending the aircraft's range. A total of 40 JetStar IIs was produced during 1976–80. The Shah's example, c/n 5203, was the third production JetStar II.

AFTER THE ISLAMIC REVOLUTION

As a result of the Islamic Revolution in Iran in 1979, the Shah's Royal Fleet was swiftly grounded, the new Islamic regime initially avoiding the use of VIP aircraft. When Ali Khamenei (now the Supreme Leader) became the third President of Iran in 1981, he started using the fleet for domestic and international flights. The Royal Hangar was renamed the Islamic Republic hangar and its six aircraft and two helicopters were all re-registered under a new Islamic regime system.

Both of the former Royal Fleet's JetStars were stripped of their original registrations and flew with serial numbers "1003" (JetStar II c/n 5203, formerly EP-VLP) and "1004" (JetStar 8 c/n 5137, the second EP-VRP), the former being President Khamenei's favourite aircraft for domestic and international flights.

In December 1990 the Iraqi authorities moved a number of Iraqi Airways aircraft to Iran in order to protect them during the impending Gulf War. Soon after the launch of Operation *Desert Storm* by an American-led coalition on January 17, 1991, the Iraqi authorities ordered the transfer of more Iraqi Air Force and Iraqi Airways aircraft to Iran, and by mid-February the Iraqis had managed to transfer 136 aircraft, including 115 fighter jets and a JetStar II. The latter was registered YI-AKD, one of five operated by Iraqi Airways for use by government officials. The remaining four Iraqi JetStar IIs — YI-AKB, 'AKC, 'AKE and 'AKF — were destroyed during coalition airstrikes on Qadisiya Air Base in January 1991.

The only operational example of Iraqi Airways' five JetStar IIs, YI-AKD was flown to Iran with two Iraqi Airways Dassault Falcon 20Fs and three Falcon 50s on January 23, 1991. All remained in storage at the IRIAF's 1st Tactical Transport Base (1st TTB) at Mehrabad International Airport in Tehran until 1993, when the IRIAF's commander-in-chief, Brig-Gen Mansour Sattari, issued a directive permitting the restoration and subsequent operation of the Iraqi aircraft. As a result they were assigned to the IRIAF's Falcon Star Squadron, for which they were given IRIAF standard serials. The Falcon 20Fs became 5-9014 and 5-9015; the Falcon 50s became 5-9011, 5-9012 and 5-9013. JetStar II YI-AKD was serialled 5-9003 (reallocated after one of the Falcon 20Fs used this serial; the latter was reserialled 5-9016). The Iranian JetStar II and 8 had been reserialled 5-9002 and 5-9001 respectively in 1991.

In 1993 the JetStar 8, 5-9001, was withdrawn from service owing to the fact that its mean time between overhaul (MTBO) had been reached. As a result, 5-9002 became the primary aircraft used by Brig-Gen Sattari. Two of the Falcon 50s, 5-9011 and 5-9012, were given the civil registrations EP-TFA and EP-TFI respectively, and assigned to the Islamic Republic hangar to be used as replacements for the JetStar.

THE LOSS OF 5-9002

At 2042hr local time on January 5, 1995, JetStar II 5-9002 crashed near the 8th Tactical Fighter Base (8th TFB) at Isfahan, killing all 12 occupants, including high-ranking IRIAF officials Brig-Gen Sattari, Deputy of Operations Brig Mostafa Ardestani and Brig Alireza Yassini of IRIAF HQ.

A few months later Khamenei, by then Supreme Leader, ordered the early retirement and/or dismissal of numerous high-ranking officers and officials in the IRIAF, leading to a rumour that the

ABOVE ***The interior of JetStar 8 c/n 5137 — originally the second EP-VRP and subsequently given the serial 5-9001 — was fitted with a wood-panelled VIP interior and could accommodate six passengers in two-tone green seats. The starboard panel of the forward cabin bulkhead incorporated an altimeter, clock and airspeed indicator.***

VIA AUTHOR x 2

ABOVE ***Behind the first row of two rear-facing seats were a bench and two more seats facing each other, as seen in this photograph looking aft. Beyond the bench and rearmost seat was a small galley, with the lavatory at the rear of the aircraft. Retired from service in 1993 after 24 years of service, 5-9001 remains in storage at Mehrabad.***

VIA AUTHOR x 2

ABOVE ***Delivered in 1976 as EP-VLP, JetStar II c/n 5203 sported the updated variant's Garrett AiResearch TFE731-3 turbofan engines and revised non-removable auxiliary fuel tanks glove-mounted on the wings in place of the previous variants' slipper tanks. Sadly, 5-9001 (as it became) was destroyed in a fatal accident on approach to Isfahan in January 1995, in which several high-ranking IRIAF officers were killed*** **(RIGHT).**

death of the popular Sattari was arranged by the Ministry of Intelligence & Security, in order to prevent any prospective coup against Khamenei.

According to the official crash investigation report by the IRIAF's Inspector General, the following reasons were determined as causes of the accident: pilot error (miscalculation of the altitude of Isfahan's airport); lack of attention from air traffic controllers in the control tower; mismanagement and lack of proper attention to flight regulations within the IRIAF's operational command, and excessive crew fatigue owing to the pilots having multiple jobs as a result of insufficient income.

At 0755hr on the day of the crash, the 1st TTB at Mehrabad had received an order from IRIAF HQ to transport Sattari and his entourage from Tehran to Kish Island on the southern coast of Iran, then return via the 8th TFB at Isfahan. It was the last day of a series of meetings of IRIAF air defence commanders at Kish Island, with Sattari giving a speech at the closing ceremony. JetStar 5-9002 landed at Kish International Airport at 0910hr, departing almost three hours later for Isfahan, where it landed at around 1500hr local time. After a 5hr stay in Isfahan, pilot Col Hossein Jamshidi and copilot Col Reza Jam-Manesh prepared the aircraft for departure to Tehran at 2000hr. The passengers boarded the aircraft, after which Jamshidi requested clearance for engine start and departure for Mehrabad International Airport at 2010hr. The control tower gave clearance for departure from Runway 26R and the aircraft departed at 2022hr.

At around 2030hr, flight engineer Capt Sanaiee noticed a warning light that the JetStar's cabin door was not properly locked. As a result, Jamshidi made a "pan-pan" call and requested an emergency landing. Air traffic control directed the aircraft back towards Isfahan. While Jamshidi flew the JetStar, Jam-Manesh and Sanaiee ran through the emergency landing checklist.

The elevation of Isfahan Airport is 5,059ft (1,542m) above sea level (asl), while that of Mehrabad, the JetStar's intended destination, is 3,749ft (1,143m) asl. Jamshidi decided to descend to 5,000ft (1,525m), but failed to remember that he had set the JetStar's altimeter for Mehrabad, some 1,310ft (400m) lower in elevation. During his last

JetStar II 5-9003 lands in the shadow of the Alborz mountains at Mehrabad in March 2009. Although this former Iraqi Airways aircraft was put into storage in 2015, it was not officially struck off charge until January 2020, marking the end of the JetStar's military and governmental career — although civilian examples continue to be operated by corporate and private owners.

BABAK TAGHVAEE

radio contact with the control tower, Jamshidi stated that he was banking for final approach. Contact with the JetStar ended abruptly at 2042hr. The aircraft impacted the ground four miles (6·5km) from the airport, killing all aboard.

THE LAST MILITARY JETSTAR

With the loss of 5-9002 in 1995 and the retirement of 5-9001 two years earlier, the ex-Iraqi Airways JetStar II 5-9003 remained the sole operational example of the type in IRIAF service. It was delivered to the Islamic Republic hangar for use by the regime's officials, mainly for domestic flights. The aircraft was rarely flown and was ultimately placed in storage in the hangar. In 2008 the aircraft underwent depot maintenance, completed in February 2009, after which four Falcon 50 pilots qualified on the type, logging training flights at Mehrabad International Airport during March 2009.

On May 12, 2009, Supreme Leader Khamenei travelled to Sanandaj in Iran's Kurdistan Province aboard his Boeing 737-286/Adv, EP-AGA. The JetStar undertook its first official mission, transporting a group of high-ranking officials from Tehran to Sanandaj. The JetStar, together with former Iranian Navy Falcon 20E 5-2803, also attached to the Islamic Republic hangar, thereafter often transported high-ranking officials and their entourages on domestic flights across the country.

On October 6, 2015, 5-9003 was used to transport government officials from Tehran to Mashhad in north-eastern Iran. During the return flight, the aircraft suffered hydraulic failure minutes after take-off and requested an emergency landing at Mashhad. The wheelbrakes were not operational because of the hydraulic failure, and the aircraft overran the runway, damaging its wing and starboard main undercarriage. The JetStar was transferred to the Dassault Mirage F1 overhaul centre at the IRIAF's Forward Air Station in Mashhad, where it was repaired over two months and flown to Mehrabad International Airport, where it was placed in storage.

In June 2013 the Mexican Air Force had retired its sole operational JetStar 8, serial 3908 (c/n 5144), which is now on display at the *Museo Militar de Aviación* at Santa Lucia. As a result, the IRIAF became the world's only military operator of the JetStar. Following 5-9003's landing incident in 2015, the aircraft had been put in storage, but had its engines run-up once a month in order to keep it in airworthy condition, and was thus still officially in service.

Following the procurement of a Falcon 900EX EASy (c/n 134) in May 2018, 5-9003 was removed from Reserve status and put in permanent storage until January 2020, when it was officially retired and withdrawn from service, marking the end of the JetStar's military career. A satellite image dated January 11, 2020, shows the aircraft being removed from the Karbar ramp at Mehrabad International Airport.

Back in 2015 the IRIAF's Strategic Research & Studies Office had made plans to transfer JetStar 8 5-9001, stored since 1993, from Mehrabad to No 11 Tactical Air Base at Doshan-Tappeh, near Tehran, to be put on display at the IRIAF museum. This never happened and 5-9001 remains stored at Mehrabad. It is highly likely that JetStar II 5-9003 has become a training aid for technical students at the IRIAF technical college.

TUESDAY THE 13th

THE TRAGIC DEMISE OF THE CIERVA AIR HORSE

70 years ago the inelegant but innovative Cierva Air Horse — still the world's only tri-rotor helicopter — suffered a catastrophic mechanical failure and plunged into farmland in Hampshire, killing two of the UK's most experienced rotary-wing pilots. With the help of an official RAE report, **NICK STROUD** investigates what went wrong that day in June 1950

TUESDAY, JUNE 13, 1950, dawned fine and warm at Eastleigh aerodrome near Southampton on the English South Coast, the nearby water meadows swollen with rainfall from recent summer showers. With a high-pressure area lingering over the Solent, the weather was perfect for another test flight of the ungainly yet innovative Cierva W.11 Air Horse, then the largest, heaviest helicopter in the world, described by British weekly magazine *Flight* as "an uncouth picture of almost Wellsian fantasy".

By the summer of 1950 the single Rolls-Royce Merlin-engined three-rotor-headed behemoth was 18 months on from its maiden flight and had completed more than 69hr of test flying, as well as putting in memorable appearances at the 1948 and 1949 SBAC shows at Farnborough. With the inelegant but technologically ambitious transport helicopter having carried a total of 17 passengers aloft the previous day, and scheduled to take another 24 up on the next, June 13 was set aside for a crew familarisation flight, chiefly for the benefit of Sqn Ldr Frederick J. "Jeep" Cable, one of the UK's most experienced rotary-wing pilots. Cable had arrived at Eastleigh to perform the initial RAF evaluation of the prototype W.11, serial VZ724, before its delivery to Boscombe Down for extensive trials with the Airborne Forces Experimental Establishment (to become part of the Aeroplane & Armament Experimental Establishment that September). He was to be accompanied on the flight by his mentor, Cierva's chief test pilot H.A. (Alan) Marsh, who had taught him to fly, and Cierva observer/test engineer H.J. (Joseph) Unsworth.

THE FATEFUL FLIGHT

The prototype was in the same configuration in which it had undergone most of its testing, the only notable technical point being that the mechanism controlling the cyclic pitch of the two rear rotors had been permanently locked. (For a brief introduction to the concept of rotary-wing flight and its terminology, see panel on page 85.) With the three aircrew aboard, Cable, in command of the machine, lifted the Air Horse from the airfield to undertake a wide circuit at an altitude of 500ft (150m) for a slow, gentle canter around the paddock before attempting anything more strenuous.

Shortly afterwards, to onlookers' horror, with no visible cues that anything was amiss on the massive machine, the air was rent by a series of loud cracks, subsequent witness statements

ABOVE ***Frederick "Jeep" Cable was taught to fly by Alan Marsh at the age of 16 and obtained his pilot's licence — for rotary-wing aircraft only — at 17. He subsequently joined Cierva and, in 1939, G. & J. Weir Ltd. After wartime service as an RAF rotary-wing-research pilot, he joined the MoS as a civilian test pilot.***

saying that "pieces of rotor blade broke away" and revealing that ". . . after the detachment of the blade pieces, the aircraft was seen first to nose up and then to enter a steep dive which continued until the aircraft struck the ground".

An official Structures Accident Note (No 228) prepared by the Royal Aircraft Establishment (RAE) at Farnborough in the immediate wake of the accident confirmed that "the aircraft had fallen into a steep nose-down attitude and was probably banked to starboard at impact". It continued: "The aircraft disintegrated on striking the ground and the two main booms supporting the rear rotors detached and were thrown forward. The wreckage, particularly that of the fuselage, was damaged extensively by fire".

The three-man crew never had a chance, and Marsh, Cable and Unsworth were all killed when the helicopter impacted farmland at West End, to the south-east of the airfield. The loss of the extensive accrued experience of the crew — Marsh and Cable in particular —represented a devastating blow to the British rotary-wing community. So what had happened?

OPPOSITE PAGE ***Rotary-wing Cerberus — the Air Horse remains the only helicopter to fly with three rotor-heads. The prototype, VZ724, is seen here during one of the public displays it made after its first free flight on December 8, 1948. Note the open door to aid cooling of the single horizontally-mounted Merlin engine.*** PHILIP JARRETT COLLECTION

PHILIP JARRETT COLLECTION

ABOVE ***Before the Air Horse came the "Spraying Mantis", a full-size mock-up of which is seen here at Eastleigh in the summer of 1946. The design, intended for agricultural work (note the large hopper for insecticide aft of the engine), incorporated forward-projecting booms with a rotor-head on each and a smaller rotor on the tailboom.***

The W.11 project was a post-Second World War development of the advanced rotary-wing work completed by the aircraft department of Scottish company G. & J. Weir Ltd in the inter-war period, incorporating a dual transverse (i.e. side-by-side) rotor layout with conventional aeroplane-type tail surfaces. In 1944 the Weir company helped reconstitute the Cierva Autogiro Company, which had been forced to suspend development on its own single-rotor designs following the outbreak of war.

The new company's first venture was for a large machine incorporating an unusual arrangement of three rotor heads with associated rotor blades and control system (the two-rotor system having proved unsatisfactory in fore-and-aft stability), powered by a single Rolls-Royce Merlin 32 engine. The machine was intended to be used for a variety of duties including passenger transport, heavy crane lift, air ambulance and crop-spraying. A preliminary brochure was issued by Cierva in July 1945 and the following month Patent No 19758, concerning "Improvements in and relating to Helicopters", detailing the theory behind the triple-rotor theory, was filed by the company.

By September 1945 the design had been revised to concentrate on the agricultural role, and incorporated a skeletal fuselage with an enclosed cabin for two pilots and a roomy hopper for insecticide, largely owing to the interest of specialist company Pest Control Ltd of Cambridge. The firm saw the advantages of a helicopter for crop-spraying, the downward push of air from the rotors providing excellent propagation of the insecticide with minimal damage to the crops. At that time working from a small office in Surrey, the Cierva management team realised that to continue to the hardware stage would require proper production facilities at an airfield, and thus the company entered into an arrangement with Cunliffe-Owen Aircraft Ltd at Eastleigh. Cierva would retain financial and technical control over the W.11 project, by the end of 1945 named the Air Horse, while Cunliffe-Owen would undertake the production of the aircraft and spares.

FROM MANTIS TO HORSE

By the spring of 1946 government bodies had taken an interest in the concept and, having inspected a mock-up of the W.11 at Eastleigh in mid-May, the Ministry of Supply (MoS) issued Civil Aviation Operational Requirement (CAOR) 3/46 on June 28, 1946. Dubbed the "Spraying Mantis", the mock-up incorporated a three-rotor configuration, with two three-bladed rotors on forward-projecting outriggers at the front and another on the aftmost end of the tailboom, and was fitted with a tank for some three tons of insecticide aft of the centrally-mounted engine.

In July 1946 CAOR 3/46 was redrafted to form Air Ministry Specification E.19/46 for a "Weight Lifting Helicopter", and Cierva was awarded a development contract for one prototype W.11 Air Horse, allocated military serial VZ724. Over the summer the RAE conducted windtunnel tests on a 1/12th-scale model of a three-rotor configuration, resulting in a number of substantial modifications to the Spraying Mantis design, the

ROTARY-WING FLIGHT FOR DUMMIES *by Dr Ron Smith FRAeS*

A FIXED-WING aircraft uses control surfaces — ailerons, elevators and rudder — to provide control in roll, pitch and yaw respectively. Lift is also controlled by means of increasing or decreasing the wing-incidence as a direct effect of pitch-control. A propeller (or jet engine) provides propulsion. A helicopter, however, has a whirling mass of rotor blades and (conventionally) a tail rotor to deliver lift and propulsion, and to control the aircraft in roll, pitch and yaw — so how does this work? In principle (and passing swiftly over a number of dynamic complications) this is how it is done . . .

The thrust generated by the rotor is controlled by increasing (or reducing) the pitch (angle of attack) of all the rotor blades at the same time. This is called **collective pitch**. This allows the aircraft to climb or descend.

Tilting the rotor-disc forward provides propulsion because a component of the thrust will then act to drive the aircraft forward. At the same time, the thrustline will move aft, producing a moment to rotate the aircraft's nose down. Similarly, tilting the rotor-disc aft will slow the helicopter and pitch the nose up. Tilting the disc to the left or right will produce roll in that direction, or sideways movement around the hover. Tilting the rotor-disc is achieved by a combination of two features:

- a hinge at the root of each rotor-blade close to the rotor head, called a **flapping hinge**;
- the ability to change the pitch on each blade as it rotates — increasing pitch at one point in the rotation, and reducing it at the opposite position of travel — this is called **cyclic pitch**. This periodic change of blade-pitch as the rotor rotates generates the forces that result in the blades changing their path with more or less flapping, thereby tilting the rotor-tip path and thrust-direction in a controlled way.

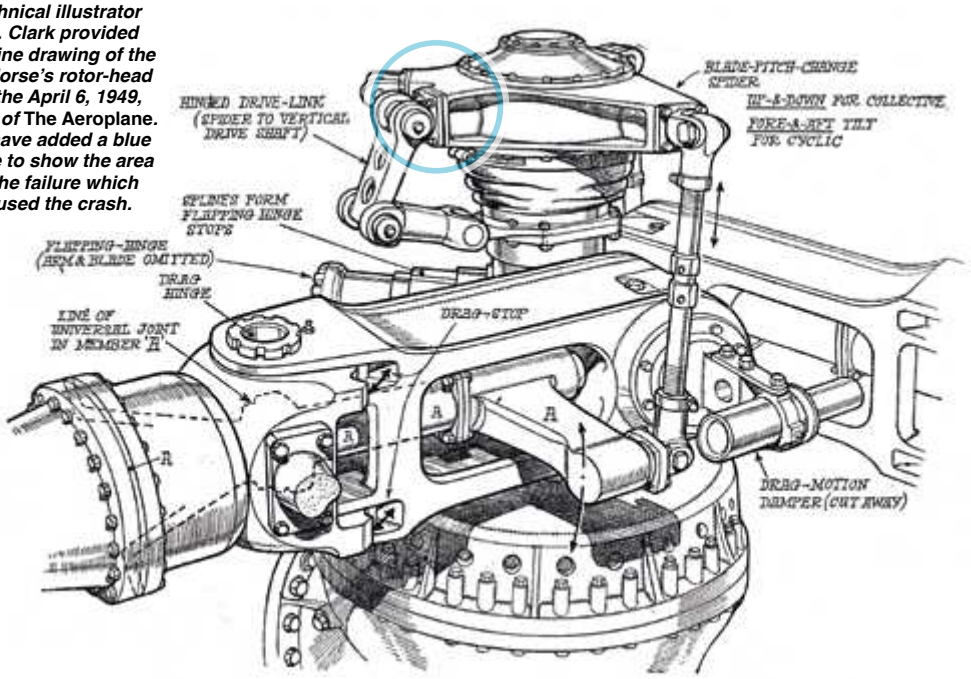
The combination of cyclic and collective pitch with a flapping hinge provides control of thrust, pitch and roll, and acceleration longitudinally and laterally. The flapping hinge not only allows the control of the rotor-tip path, but it also substantially eliminates periodic bending moments being transferred to the rotor hub, improving its fatigue life.

When power is applied to the rotor, there is an equal and opposite reaction to the torque applied to the main rotor, tending to spin the helicopter in the opposite direction. In a conventional helicopter a smaller rotor mounted vertically at the rear of the fuselage, or on the fin, is used to react against this tendency and to control the aircraft in yaw.

According to a comprehensive article about the technical aspects of the Air Horse in the December 17, 1948, issue of *The Aeroplane*, the flight controls presented to the pilot were conventional, but their inputs were fed into a "control exchange" mechanism that sorted out the inputs to the collective and cyclic controls of each rotor. Furthermore, it explains, "control about the pitching and rolling axes is accomplished by means of lift moments generated from differential application of collective pitch to the three rotors. Control about the yawing axis is brought about by cyclic-pitch variation in the fore and aft direction, applied differentially to the side-by-side rear rotors. This results in a virtual fore-and-aft tilt of these rotor discs, giving horizontal thrust components with a yawing couple between them".

***Dr Ron Smith** was a Westland Research Aerodynamicist 1975–79; Head of Future Projects 1980–86; Chief Design Engineer (LAH) 1986–1990; Chairman of the Royal Aeronautical Society Rotorcraft Group Committee, 1991–93*

Technical illustrator J.H. Clark provided this fine drawing of the Air Horse's rotor-head for the April 6, 1949, issue of* The Aeroplane. *We have added a blue circle to show the area of the failure which caused the crash.



ABOVE ***With the second of the two Cunliffe-Owen Concordias, G-AKBE, in the background, work progresses on the first W.11 Air Horse prototype, VZ724, at Eastleigh in the spring of 1949. The extreme nose of the Air Horse's fuselage could be opened, as seen here, to give access to the rear of the instrument panel and pilot's controls.***

PHILIP JARRETT COLLECTION x 2

ABOVE ***The Air Horse made its public debut at the 1948 SBAC show at Farnborough that September, a month before it began its ground running and tethered hovering trials, and three months before its first free flight. Fitted with its original small fins, it wears its civil registration, G-ALCV, allocated during August–October 1948.***

By this time fitted with fins of increased area, VZ724 clatters overhead during a flight in 1949, possibly at that year's SBAC show, at which it performed a memorable flying display. The fins never incorporated rudders, yaw control being effected by means of fore-and-aft cyclic-pitch variation applied differentially to the rear rotors. PHILIP JARRETT COLLECTION

most obvious being the relocation of the single rotor from the tail to an extended boom over and forward of the cockpit (for better fore-and-aft pitching control) and the deepening and covering of the fuselage to allow for the carriage of freight or passengers. A Merlin 24 engine also replaced the 32, the former being the standard variant used for civil applications at the time.

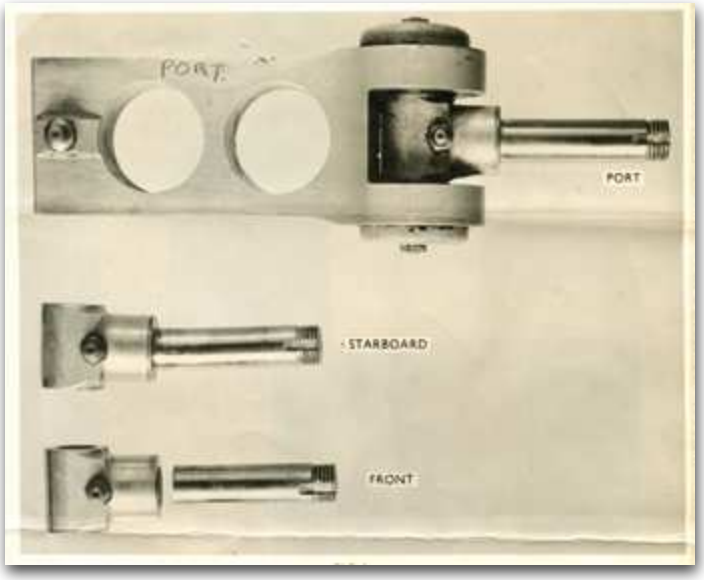
Construction of the prototype began at Cunliffe-Owen in 1947, although the latter company (undergoing severe financial struggles in the post-war market) was dissolved later the same year, leaving Cierva to draft help in from Vickers-Armstrongs (Supermarine) personnel at Eastleigh. These logistical and financial problems notwithstanding, work progressed — albeit rather slowly — on the Air Horse, and VZ724 was rolled out of the factory at Eastleigh in August 1948, to be put on a lorry for transport to Farnborough, where it garnered much attention at that year's SBAC show as a static exhibit. In the meantime, a second prototype (allocated serial WA555) had been ordered in 1947.

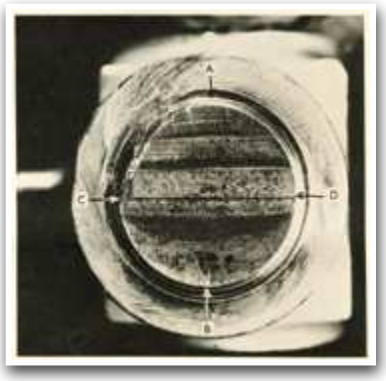
Following its return to Eastleigh, the prototype began tethered trials and ground runs from October 1948. It was piloted by Alan Marsh for its first free flight on December 8 that year, its all-up weight of 14,600lb (6,620kg) being the highest ever to be supported by rotary-winged flight. An extensive flight-test programme followed; this identified the need for an increase in the area of the twin fins, and modifications to the outrigger booms to palliate some recurring resonance issues. These changes were made after the machine had been stripped down for a thorough examination in the first half of 1949.

Test flying resumed in the summer of 1949, and the rotary-wing goliath became one of the stars of the 1949 SBAC show at Farnborough, its "extraordinary shape and great lazily turning blades creating a most vivid impression", according to veteran commentator John Blake. The test programme continued apace thereafter, with full-load and autorotation trials having been completed by the end of the year. Despite Pest Control Ltd having found a method of using much smaller helicopters to fulfil its needs, and thus fading from the Air Horse development story, the turn of the new decade saw Cierva with much to be optimistic about, with the test programme of VZ724 progressing well and second prototype WA555 nearing completion by February 1950. The government remained interested in the type, focusing on its potential use as an invaluable agricultural tool in overseas territories, Southern Rhodesia in particular, and prospective turboprop and twin-Merlin-powered versions were also mooted (see page 91).

THE FINAL FENCE

Thus it was that the future looked secure and bright for the Air Horse on the morning of June 13, 1950, when Sqn Ldr Cable lifted VZ724 from the airfield at Eastleigh for his ill-fated





PHILIP JARRETT COLLECTION x 2

ABOVE ***The fracture surface from head-on. Failure had occurred at the change of section from 0·8in (20mm)-diameter to 0·5in (12·7mm)-diameter, and had originated by the initiation of fatigue cracks at diametrically opposite sides, as denoted by arrows "A" and "B" (essentially perpendicular).***

ABOVE LEFT ***Accompanying the RAE's Structures Accident Note were a number of photographs and illustrations of the relevant parts, including this photograph showing the fractured front rotor swashplate spindle (bottom), alongside the (slightly bent) starboard spindle (middle) and port spindle still attached to one arm of the scissor link.***

familarisation flight. As mentioned, the machine had undergone a complete strip-down and examination the previous year — yet the ensuing tragedy revealed all too vividly that there was a serious problem which would need to be investigated, clarified and addressed as soon as possible. In its issue of July 7, 1950, *The Aeroplane* magazine reported the following:

"At the resumed inquest at Southampton on June 28 . . . a verdict of death by misadventure was recorded. During the evidence it was stated that . . . on a test flight prior to the final flight Alan Marsh reported that the vibration level was of the same order as that on a previous test and that, if it remained at that level, the aircraft would be satisfactory."

So what had gone so catastrophically wrong?

THE OFFICIAL REPORT

The opening summary of the RAE's Structures Accident Note No 228, dated August 1950, states the dry fact that "the accident was due to the failure in fatigue of a component of the swashplate-driving link in the front rotor head . . . resulting in the loss of the aircraft". Examination of the crash site revealed that several pieces of blade, subsequently identified as parts of one of the front rotor blades, were found distributed in the direction of flight for a distance of around 250–300yd. The three rotor heads had detached from their respective booms and the blades had completely disintegrated on impact. Inspection of the front rotor head revealed a fatigue failure in a spindle, the function of which was to transmit drive from the rotor head to the swashplate controlling the blade pitch.

Suggesting what may have happened as a result of this fracture, the Accident Note goes on to say "that an increase of collective pitch of the blades of about 7° could follow a failure of a swashplate driving link in flight due to the pull of the blade-control links as the swashplate lagged behind the rotor head". Having established that it was a fatigue failure of a component of the front rotor head, the RAE report revealed that "there is evidence of a strike by a rotor blade on the starboard rear rotor boom on its inboard edge adjacent to its connection with the fuselage. An assessment of this strike indicates that it was made by a front rotor blade".

Paragraph 6.1 of the Accident Note explains that "the effects of failure of the swashplate driving link would include an increase in collective pitch and a change in the phasing of cyclic pitch. These effects would produce initially an increase in the lift of the front rotor as the blades collectively increased pitch, but stalled conditions would rapidly spread on the retreating side with consequent loss of lift and disturbances of the flapping motion".

Paragraph 6.2 continues:

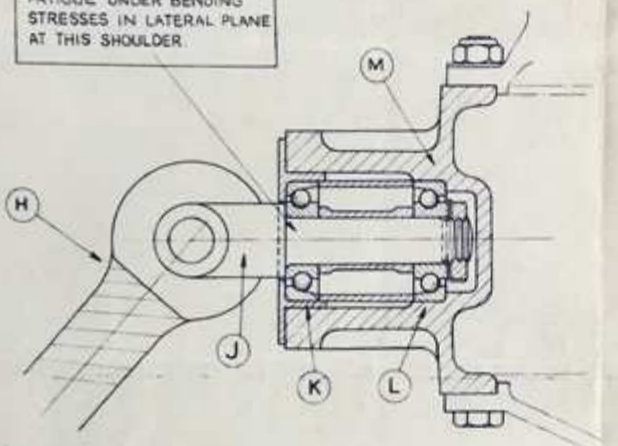
"Should blade motion become disturbed as per Paragraph 6.1, it would be possible for one or more of the front rotor blades to flap sufficiently to reach the droop stops, and this interference with the stops would set up more severe conditions in the blade, causing it to strike the fuselage or booms supporting the rear rotors. The evidence of the strike on the starboard boom supports this and it therefore seems probable that this strike was the reason for the failure in the air of the front rotor blade."

CONFIDENTIAL

STRUCT. ACC. NOTE 228
FIG.1

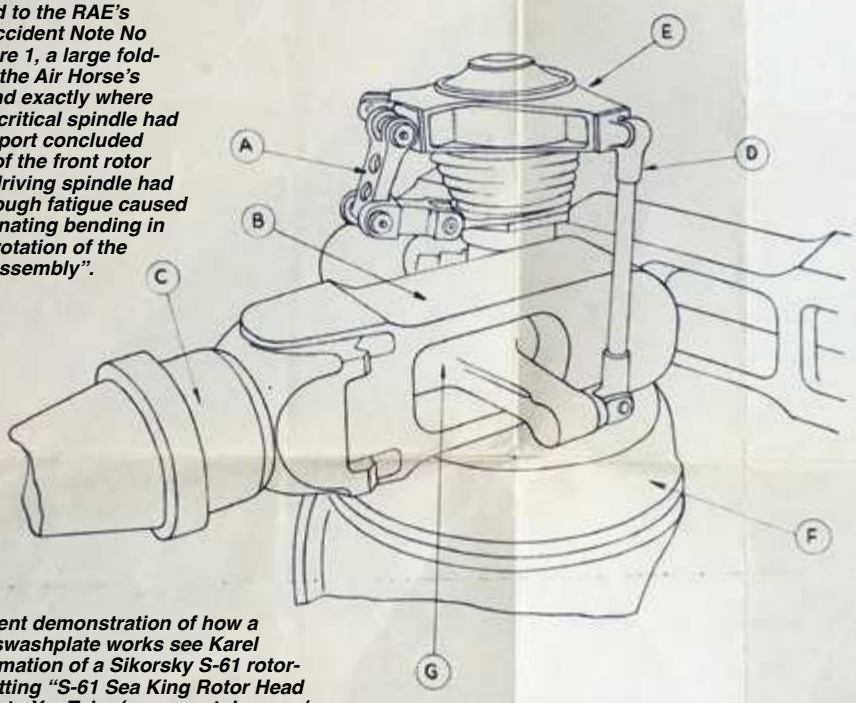
SPINDLE FAILED IN FATIGUE UNDER BENDING STRESSES IN LATERAL PLANE AT THIS SHOULDER.

KEY	
A	SWASHPLATE DRIVING LINK
B	FLAPPING HINGE ARM
C	BLADE ROOT
D	CONNECTING LINKS
E	SWASHPLATE
F	GEARBOX
G	BLADE PITCH CRANK
H	SWASHPLATE DRIVER TOP LINK
J	SPINDLE
K	OUTER BALL RACE
L	INNER BALL RACE
M	SWASHPLATE HOUSING



SECTION ON ℄ OF SPINDLE

Also attached to the RAE's Structures Accident Note No 228 was Figure 1, a large fold-out detailing the Air Horse's rotor-head and exactly where and how the critical spindle had failed. The report concluded that "failure of the front rotor swashplate-driving spindle had occurred through fatigue caused through alternating bending in the plane of rotation of the swashplate assembly".



For an excellent demonstration of how a helicopter's swashplate works see Karel Kinable's animation of a Sikorsky S-61 rotor-head by inputting "S-61 Sea King Rotor Head Animation" into YouTube (www.youtube.com/watch?v=83h6QK-oJ4M).

FIG.1 ILLUSTRATION OF ROTOR HEAD SHOWING LOCATION OF FAILED LINK AND SECTION AT SEAT OF FAILURE.
CIERVA "AIR HORSE" V.Z. 724.

PHILIP JARRETT COLLECTION

ABOVE ***Little and large — another photograph of the prototype Air Horse at the 1948 SBAC show, alongside G-AJCJ, the prototype of its diminutive stablemate, the Cierva W.14 Skeeter, which made the type's maiden flight at Eastleigh the following month. The Skeeter went on to be developed and built in numbers by Saunders-Roe.***

So a fatigue failure of a vital rotor-head component in flight had caused the front rotor to oscillate wildly before striking the starboard boom and setting in train a catastrophic sequence of events. Why had the component failed? Appendix I of the RAE Structures Accident Note digs into the fatigue failure and its causes and concludes the following:

"Failure of the front rotor swashplate driving spindle occurred by fatigue caused through alternating bending in the plane of rotation of the swashplate assembly. Though the loading on the spindle in service was regarded to be light, the very rough surface finish given to the 0·03in (0·8mm) radius, together with the wear and attrition caused by play of the roughly surface-finished inner race of the outer ball race, were sufficient to cause a high concentration of fluctuating stresses that resulted in the formation of fatigue cracks.

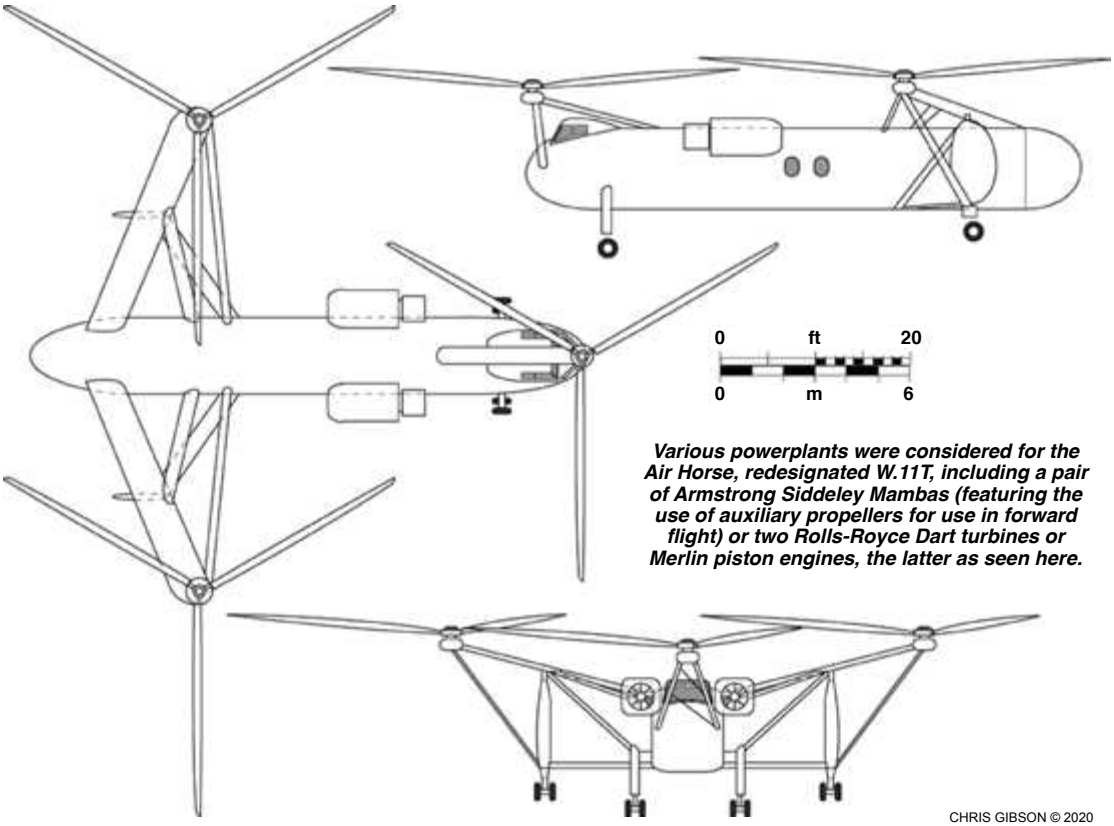
"The very small amount of material that had not failed by fatigue does suggest that the steady load carried by the spindle in service was not very great. The superimposed fluctuating load was, however, sufficiently high to initiate fatigue cracks. No fatigue cracks were found in the starboard and port spindles but showed evidence of wear and attrition."

So the culprit had been found; one of the smallest moving parts of what was then the world's largest helicopter had sent it tumbling. In a 1978 article for *Aeroplane Monthly*, helicopter historian Elfan Ap Rees later wrote that "it has been speculated that had Alan Marsh been in the driving seat, he might have known immediately what to do, simply because this very problem had been discussed earlier among the Cierva team". We shall of course never know.

THE AFTERMATH

Naturally, the accident had an immediate and considerable effect on the Air Horse project, and the second prototype, WA555, which had completed around 20hr of ground-running tests by that time but had yet to fly, was comprehensively stripped down for extensive investigative work. With Pest Control Ltd's interest having waned completely and the MoS understandably wary of adding more financial commitment to the £350,000 it had already spent on the programme, it was up to Cierva to decide whether to continue the project or focus on its somewhat smaller and more manageable W.14 Skeeter helicopter. The company had too little income to press on with a sizeable and technologically complex private venture, and ultimately James Weir withdrew his backing from the Air Horse project. The future suddenly looked decidedly grim for Cierva.

Fortunately, Saunders-Roe, which had occupied premises at Eastleigh since 1937, stepped into the breach and took over some of



Various powerplants were considered for the Air Horse, redesignated W.11T, including a pair of Armstrong Siddeley Mambas (featuring the use of auxiliary propellers for use in forward flight) or two Rolls-Royce Dart turbines or Merlin piston engines, the latter as seen here.

Cierva's design commitments, all its premises and most of its technical staff, to form its Helicopter Division in January 1951. The Skeeter would continue to be developed, but the Air Horse was deemed a project too far and was all-but abandoned in development terms.

Nevertheless, and perhaps surprisingly, the second prototype was reassembled to continue research into the swashplate failure that had done for its older brother. It was ultimately established that the front spindle had been adversely affected by a high-frequency secondary vibration from the engine, from which the rear rotors were isolated. Although WA555 never made a free flight of its own, it was used for rotor-hub development and other research work until late 1953.

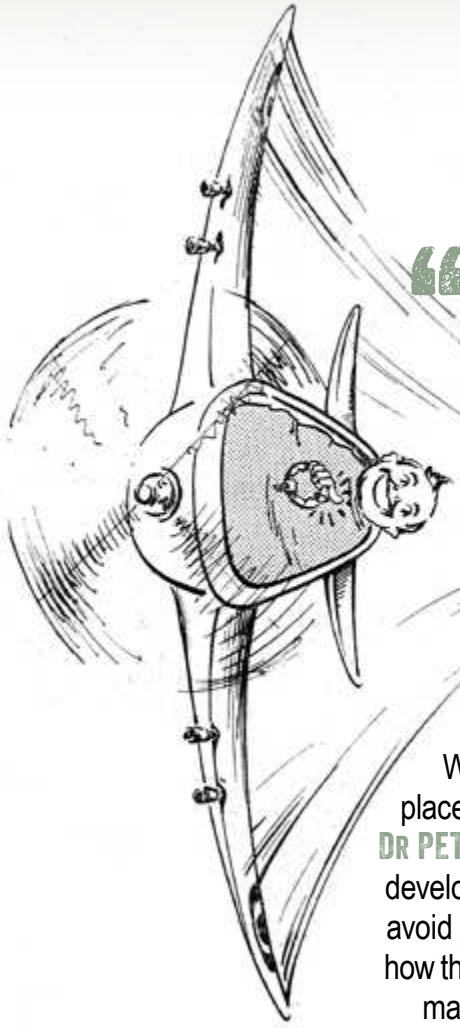
In February 1954 instructions were issued to dismantle WA555 and make it ready for its removal from Eastleigh by road. It was transported in June 1954 to an MoS depot at Byley in Cheshire, where it remained dismantled until 1960, when it was ignominiously scrapped on site. From having been a promising yearling little more than a decade previously, the Air Horse had run its final furlong.

ACKNOWLEDGMENTS *The author would like to thank Philip Jarrett for providing the RAE Structures Accident Note and Dr Ron Smith and Chris Gibson for their invaluable help during the preparation of this article*

CIERVA W.11 AIR HORSE DATA

Powerplant 1 x 1,610 h.p. Rolls-Royce Merlin 24 liquid-cooled piston engine

Dimensions		
Rotor diameter	47ft 0in	(14·32m)
Width overall	95ft 0in	(29m)
Length overall	88ft 7in	(27m)
Height overall	17ft 9in	(5·41m)
Distance between rotor centres		
fore-aft (longitudinal)	41ft 7in	(12·7m)
rear	48ft	(14·63m)
Wheel track	30ft 11in	(9·42m)
Wheelbase	20ft 10½in	(6·36m)
Weights		
Empty	12,140lb	(5,505kg)
Payload with full tanks	3,755lb	(1,704kg)
Gross	17,500lb	(7,937kg)
Performance (estimated)		
Maximum speed at sea level	140 m.p.h.	(225km/h)
Max cruising speed	116 m.p.h.	(187km/h)
Climb		
max vertical at sea level	790ft/min	(249m/min)
max inclined rate at sea level	1,210ft/min	(370m/min)
Maximum range	330 miles	(530km)
Service ceiling	23,300ft	(7,100m)



FLYING THE "BATHFIRE"

BRITAIN'S WARTIME "ANTI-G SUIT" RESEARCH AND DEVELOPMENT

As the performance of fighter aircraft advanced almost daily during the Second World War, so the physical demands placed on the pilots flying them increased. **DR PETER HOBBINS** traces Britain's wartime development of "anti-g suits", devised to avoid pilots blacking out, and explains how the early tactical advantage they may have provided was lost

RAF MUSEUM LIBRARY

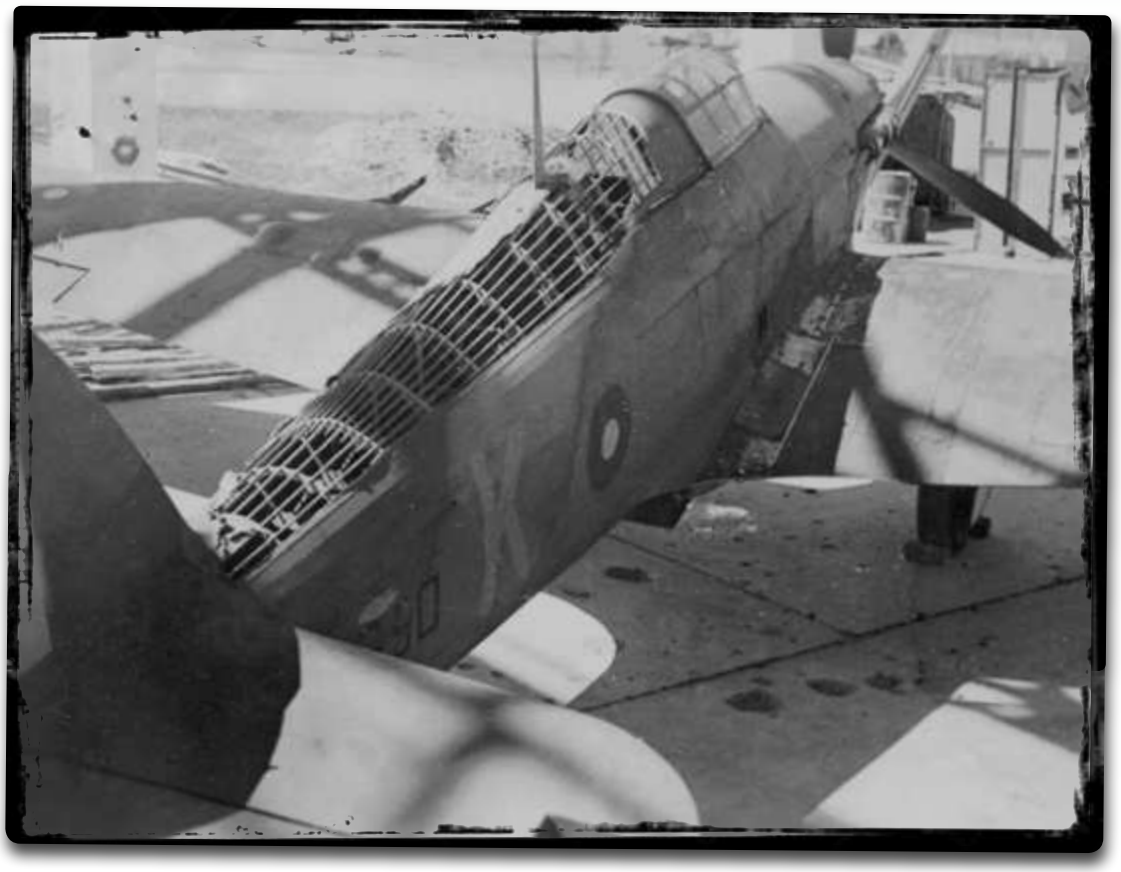
MONTY COTTON surveyed his Hawker Hurricane IIC with a mixture of alarm and perverse pride. A large swathe of fabric had torn clear of the top decking, exposing the rugged structure beneath. The result of strenuous aerobatics above Ceylon (now Sri Lanka), it proved two points. First, the damage illustrated that Hurricanes were simply inadequate for modern air operations over Asia. Second, it confirmed the potent advantages claimed for the Franks Flying Suit.

Summarising No 17 Sqn RAF's field trials with this "most secret" anti-g garment, Sqn Ldr Cotton drove home its combat potential. "The enclosed snapshots taken of my Hurricane . . . testify to the high speed and the violence of the manœuvres I was doing", the Australian stated in a December 1943 report. A wily commanding officer, Cotton cited both structural and tactical reasons for supplying his unit with more modern fighters. "The day will undoubtedly dawn when we shall be re-equipped with machines such as [Supermarine] Spitfires or [Hawker] Typhoons which will be capable of holding g in a high-speed turn longer than the Hurricane", he hinted. This enhanced manœuvrability would transform combat against agile Japanese types, encouraging the use of anti-g suits "as a weapon of offence rather than defence".[1]

BLACKOUT AND BUCKLED AEROPLANES

Cotton's report arrived at a critical time for British anti-g policy. Since 1940 the RAF and Fleet Air Arm (FAA) had supported the development and production of the Franks Flying Suit, more generally known as the FFS or Franks Suit. Devised by Canadian medical scientist Wilbur "Bill" Franks, the outfit

ABOVE ***This cheerful drawing of a pilot happily flying a well-armed bathtub — or "Bathfire" — provided a vivid illustration of the principle behind the Franks Flying Suit in a 1944 Air Ministry pamphlet issued to explain the system and how it worked. The suit was effective, but considered uncomfortable and burdensome by most pilots.***



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ABOVE ***The top decking of Monty Cotton's Hurricane IIC was torn off during vigorous trials of the Franks Flying Suit by No 17 Sqn in Ceylon in late 1943. Cotton said: "There is nothing more conducive to good moral[e] in a dogfight than being able to out-turn one's opponent — up until now it has been impossible against the Jap[anese]".***

resembled a pair of rubberised fisherman's waders that were filled with 2 Imp gal (9lit) of water once the pilot was strapped in.[2]

Its principle was that under conditions of high g (see panel on page 94), both the pilot's blood and the water would be forced toward his legs. Since the tightly laced suit could not expand, the water would compress his legs and lower torso. Helping to prevent blood draining from his brain and eyes, it delayed g-induced "blackout" and reduced the fatigue that many aviators experienced after energetic aerial engagements. Owing to the FFS's unique "hydrostatic" mode of action, the training manual quipped that wearing it was equivalent to flying in a bathtub — or, alluding to the Supermarine fighter, piloting a "Bathfire".[3]

The fundamental benefit claimed for the Franks Suit was that it allowed pilots to tolerate an additional 2g for 5–10sec, a significant combat advantage. Indeed, the outfit was so effective that there were concerns that flyers might exceed their aircraft's structural limits. Trialling an early FFS in his No 601 Sqn Hurricane IIB in July 1941, for instance, Plt Off Frank Jensen "went to 9g without blacking out, and, in the process thereof, buckled the aeroplane".[4] Although one solution was to strengthen aircraft to withstand 8g manœuvres, it would increase weight and diminish agility. Instead, agreed an October 1941 conference, a better tactical utilisation of this innovative garment was to permit pilots to sustain lesser loads of up to 5–6g regularly.[5]

During 1941–42 many UK-based RAF units trialled the FFS, including Nos 43, 56, 74, 151, 245, 601, 604, 609 and 615 Sqns, plus the Air Fighting Development Unit (AFDU). Types tested included the Hurricane, Spitfire, Typhoon, Boulton Paul Defiant and Bristol Beaufighter. By July 1942 pilots at the Naval Air Fighting Development Unit (NAFDU) were also exploring its value in Seafires, Sea Hurricanes, Grumman Martlets and Fairey Fulmars.

Admiralty aviators were in fact the first to demonstrate the FFS's combat value. Launching from *HMS Furious* in October 1942, No 801 Sqn's

UNIVERSITY OF SYDNEY ARCHIVES

SEAFIRE PILOT SUB-LT JIMMY RANKIN GLOATED THAT 'I JUST TURNED INSIDE HIM WITHOUT ANY TROUBLE AT ALL…'

LEFT ***Medical scientist Sqn Ldr Wilbur "Bill" Franks, RCAF (centre), demonstrates the lacing technique for the FFS Mk II circa 1942. Franks had been exploring g-induced blackout in Canada since 1938, and in June 1940 an extremely valuable Spitfire I was sent to Canada for FFS trials, suggesting that his work was being taken very seriously indeed.***

FROM GREYOUT TO G-LOC

BY THE 1930s g-induced blackout was an acknowledged problem during high-energy aerial manœuvres. Recovery from steep dives or tight turns at high speed creates a downward force on flyers' bodies more powerful than the normal effect of gravity (1g). Draining blood into the legs and abdomen, a high amount of g deprives the eyes and brain of oxygen. The stronger or longer this "g force" is sustained, the greater the risk to the pilot experiencing it. For typical military aviators, a period of 5sec at 5g causes vision to fade — a sensation known as "greyout". A few seconds more, or higher g, produces total loss of vision or "blackout". The next stage — g-induced loss of consciousness (G-LOC) — is equivalent to fainting at the controls, with potentially disastrous consequences for the pilot and his aircraft.

By 1945 numerous physiological, postural and mechanical methods had been developed to counteract g. *[For more on Germany's attempts to counter this see Brett Gooden's* Absolute Beginners *article on the Bachem Ba 149 Natter in* TAH28 *— Ed.]*. The simplest was for flyers to tense their stomach muscles to reduce pooling of blood in the abdomen. Raising the legs via auxiliary rudder pedals, as in the Messerschmitt Bf 109, had a similar effect to crouching forward or fitting reclined seats, as adopted in the Supermarine Spiteful. The effect was to keep the legs and head as close to the level of the heart at possible, reducing how hard it had to pump to maintain blood flow to the brain. A variation on this logic was the prone-pilot position, tested in the Northrop XP-79. Automatic dive-recovery devices, fitted in the Junkers Ju 87, compensated for pilots who lost their vision or suffered G-LOC during pull-out. **PH**

Seafire IBs and No 807 Sqn's Seafire IICs fought Vichy French Dewoitine D.520s over Oran in Algeria. Wearing the inaugural operational FFS variant — the Mk II — FAA pilots praised its value against these nimble French fighters. Sub-Lieutenant "Jimmy" Rankin, for instance, gloated that "I just turned inside him without any trouble at all".[6]

One immediate result was an order for 2,000 suits from Dunlop's Manchester factory. Another was the decision not to introduce this potent new technology piecemeal. Rather, urged Air Chief Marshal Sholto Douglas, head of Fighter Command, the FFS should remain secret "until all pilots can be equipped at the same time in circumstances when the springing of a surprise on the enemy is strategically desirable".[7] Douglas furthermore forbade the use of any Allied anti-g equipment over enemy territory. Although logical, this security imperative had far-reaching and ultimately self-defeating consequences for Britain's lead in anti-g technology and equipment.

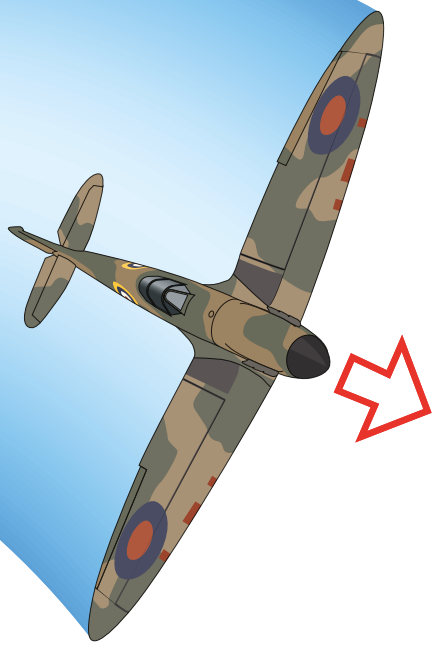
EFFECTIVE — BUT IMPRACTICAL

Anti-g garments were largely an achievement of the western Allies. The Germans had explored the concept but had abandoned it by 1939, and neither Italian nor Soviet examples are known.[8] Although several styles of Japanese anti-g garment were captured in the Pacific, their operational employment during the Second World War remains poorly documented.

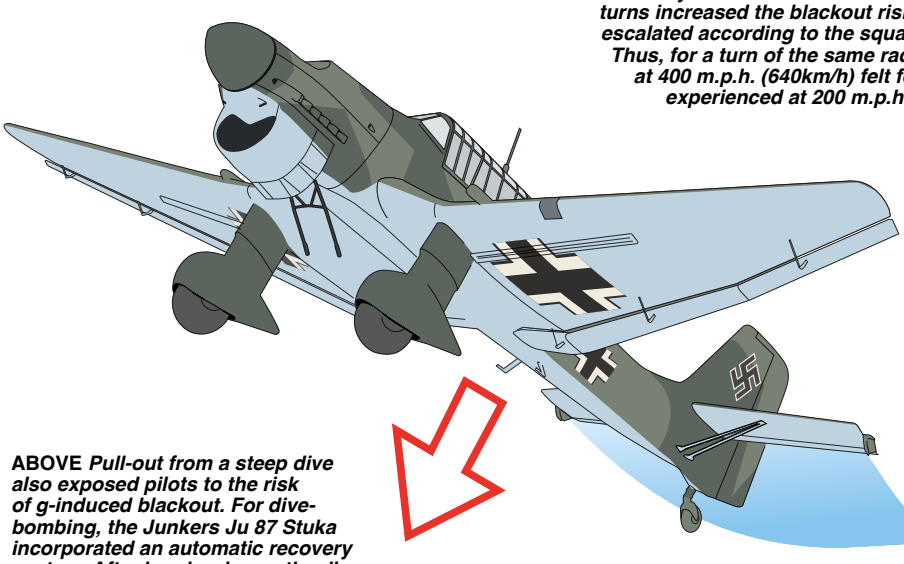
Franks's hydrostatic principle also proved to be a unique line of development. Most USAAF and US Navy anti-g garments were operated

ABOVE *The Allies appeared to lead the field of anti-g clothing during the war, as there is little evidence to suggest that the Italians or Soviets developed any such equipment. The Germans undertook anti-g research before the war, ultimately abandoning the idea in 1939. The Japanese appeared to use anti-g clothing operationally, however, as this captured Japanese lace-up abdominal-constriction vest proves.*

NATIONAL AIR & SPACE MUSEUM



ABOVE *Loss of consciousness induced by gravitational force first became a serious concern for British pilots flying the Supermarine racing seaplanes developed for the Schneider Trophy air races of the mid-1920s/early 1930s. As Hurricane and Spitfire pilots discovered at the end of the 1930s, the greatest risk occurred during tight turns at high airspeed. Centrifugal acceleration grew inversely with the radius of the manœuvre; tighter turns increased the blackout risk. More critically, g escalated according to the square of the airspeed. Thus, for a turn of the same radius, a pilot flying at 400 m.p.h. (640km/h) felt four times the g experienced at 200 m.p.h. (320km/h).*



ABOVE *Pull-out from a steep dive also exposed pilots to the risk of g-induced blackout. For dive-bombing, the Junkers Ju 87 Stuka incorporated an automatic recovery system. After bomb-release, the dive brakes retracted, the propeller was set to coarse pitch and the elevators deflected to instigate a climb until the pilot regained control.*

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ABOVE ***The FFS was intended to be worn beneath normal uniform, as demonstrated by this Fleet Air Arm (FAA) pilot at the Naval Air Fighting Development Unit in July 1942. Reports by the FAA on the FFS during Operation*** **Torch** ***in late 1942 proved critical to sustaining the momentum for the development of Allied anti-g equipment.***

by compressed gases. Rapidly inflating at high g, they squeezed the pilot's lower body to reduce the pooling of blood and hence delay blackout.[9] These American developments were influenced by an Australian design, the Cotton Aerodynamic Anti-g (CAAG) suit. Its originator was medical scientist Frank Cotton — coincidentally, Monty Cotton's cousin.

Unfortunately, as Royal Australian Air Force (RAAF) and RAF pilots discovered, the CAAG suit was unsuited to Australia's tropical north.[10] The rubberised outfit was complex, hot, heavy and cumbersome — especially when scrambling or attempting to bale out of their notoriously narrow Spitfire Vs and VIIIs. As Monty Cotton admitted, his cousin's garment was indeed effective — but also "impractical".[11]

Similar issues dogged the FFS. Although delivered in seven sizes to allow for varying girths and heights, it required careful lacing for each pilot.[12] Filling with water also took several minutes — a critical consideration when scrambling. Another major disadvantage, noted one FAA officer, was the "great loss of feel due to the insulation of the pilot from the aircraft. Particularly his bottom".[13] The FFS not only hampered the proverbial "flying by the seat of the pants", it also prompted an often-obsessive urge to urinate, without offering an effective relief outlet. Nevertheless, the suit remained buoyant even when filled, and naval aviators particularly welcomed it as a source of fresh water should they come down in the ocean. Although the rubber garment could be filled with warm water — making it "a decided asset in cold weather" — it caused excessive perspiration and proved unbearably hot while waiting at readiness in the tropics.[14]

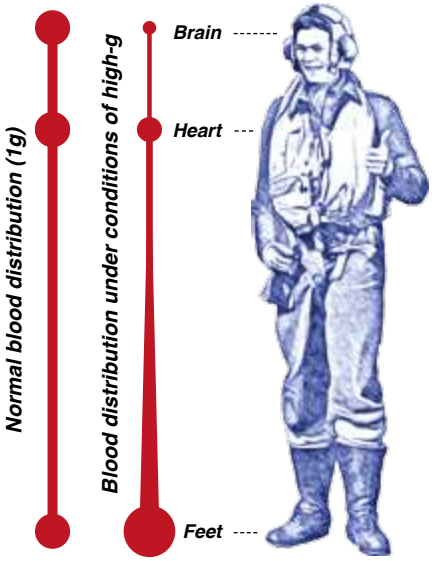
CRITICAL DELAYS IN OPERATIONAL USE

Despite growing concerns over its practicality, FFS orders escalated through 1943. The RAF stockpiled 2,000 suits to provide one for every UK-based fighter pilot, while another 1,700 were allocated for FAA aircrew. During this period the FAA's Nos 787, 800, 804, 807, 808, 809, 878, 879, 880, 881, 886, 890, 893, 894, 897 and 899 Sqns explored the FFS in their Seafires, Martlets and Hellcats. Pilot feedback remained sufficiently encouraging for the Admiralty to decree in December 1943 that "Frank's [sic] Flying Suits will be provided for the flying crews of all single-seater fighters, two-seater fighters and dive-bombers".[15] By mid-1944, therefore, it was intended that every British fighter pilot would wear an anti-g suit to heighten air superiority during the invasion of Europe.

Overseas testing was also an RAF priority. In May 1943, 60 suits were despatched for trials with No 145 Sqn in Malta, alongside 25 for No 17 Sqn in Ceylon. Although deployment from these islands minimised the risk of capture, the conclusion of the North African campaign in June meant that Malta-based Spitfire VB pilots

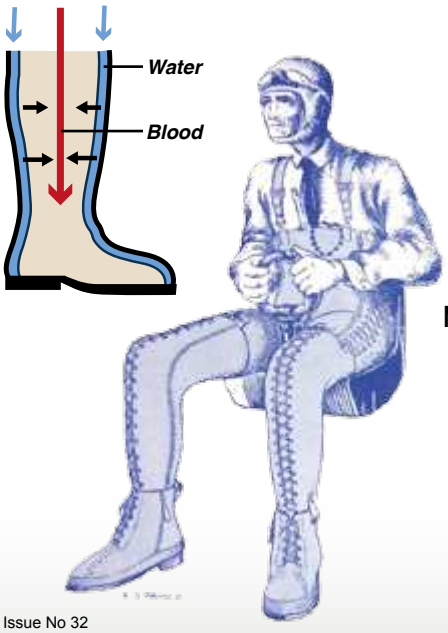
GRAVITY & BLOODFLOW

The centrifugal acceleration encountered during manœuvring, known as g, acts on the blood, forcing it down to the feet. When the heart can no longer pump against the g being sustained, the blood supply to the brain is reduced and the pilot suffers "greyout" or, if for prolonged periods, "blackout"



THE FRANKS FLYING SUIT

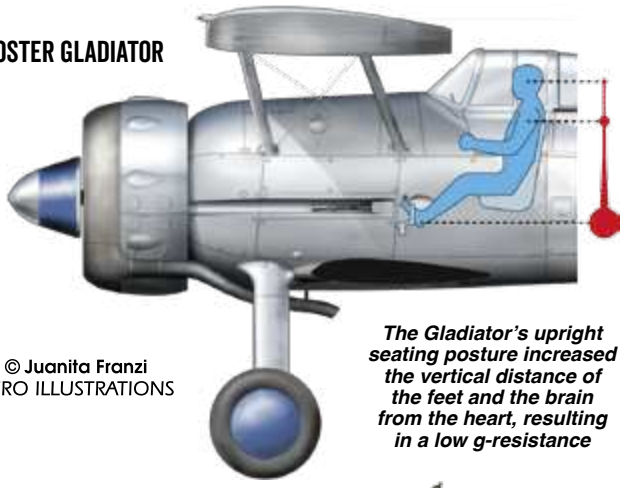
Under conditions of high g, both the pilot's blood and the water in the Franks Flying Suit are pulled towards his feet. Because the suit does not expand, the water pressure acts inwards to "squeeze" the flyer's legs in proportion to the level of g. This pressure minimised blood-pooling, helping maintain blood flow to the pilot's head



COCKPIT DESIGN EVOLUTION

By the mid-1930s aircraft designers were experimenting with postural solutions to reduce pilots' vulnerability to g. Below are some examples of the methods used to address the issue, using types that exemplarise such methods

GLOSTER GLADIATOR

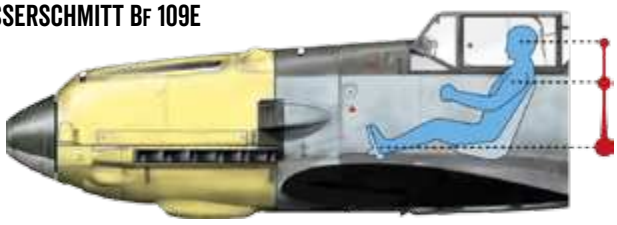


The Gladiator's upright seating posture increased the vertical distance of the feet and the brain from the heart, resulting in a low g-resistance

HAWKER HURRICANE

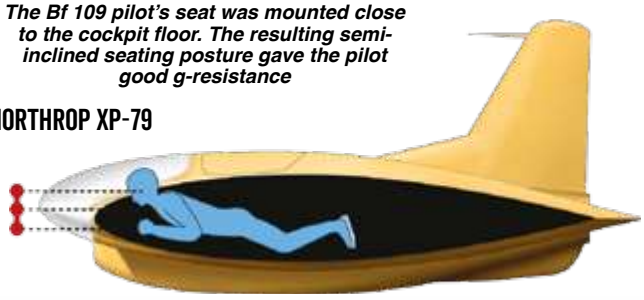
The Hurricane's rudder pedals were fitted with an accessory bar allowing the pilot to raise his feet for higher g-resistance during manœuvring

MESSERSCHMITT Bf 109E



The Bf 109 pilot's seat was mounted close to the cockpit floor. The resulting semi-inclined seating posture gave the pilot good g-resistance

NORTHROP XP-79



The prone-pilot position, i.e. lying forward, minimised the effects of g by keeping the brain, heart and feet on a similar level. It had drawbacks, however, being uncomfortable for prolonged periods

LEFT ***Rather resembling a bizarre Expressionist human sculpture installation, this photograph shows the FFS Mk III, which incorporated many functional improvements over the Mk II, particularly with regard to pilot comfort and the speed at which it could be filled and drained. The FFS Mk III was widely deployed by the FAA during 1944–45.*** THE NATIONAL ARCHIVES VIA AUTHOR

had "little opportunity of trying out the suit operationally except in circumstances where it might fall into enemy hands".[16] Ongoing secrecy concerns also meant that Franks Suits played no part in the 1943 invasions of Sicily and Italy, even as another 2,000 outfits were ordered for RAF pilots in overseas commands.

With FAA flyers frustrated at being unable to develop combat experience and tactics, USAAF commanders likewise demurred to RAF wishes and withheld anti-g equipment from escort missions above Europe. Now receiving their own gas-operated G-1 garments, the Americans requested 500 Mk III Franks Suits for comparative evaluation. The RAAF likewise toed the line, employing CAAG suits only above Australia. Thus, by the time that Monty Cotton's report arrived from Ceylon in late 1943, RAF policy was hindering operational use of Allied anti-g suits around the globe.

Finally, on February 26, 1944, the RAF decreed that anti-g equipment could be downgraded to "Secret" and deployed over enemy territory from April 1.[17] This decision coincided with an intelligence assessment that the Germans would require six months to make "Chinese copies" of captured Franks Suits.[18] By this time, 1,700 garments had been delivered, with orders totalling 8,770: 4,570 for the RAF; 3,700 for the Admiralty and 500 for the USAAF. The time at last seemed ripe for the mass equipment of air-defence and 2nd Tactical Air Force (2TAF) squadrons in advance of Operation *Overlord*.

THE RAF LOSES INTEREST

Yet it was at this critical moment — just months out from D-Day — that the RAF's anti-g programme began to fall apart. Undertaking trials in Scotland during November 1943–January 1944, Spitfire VB pilots of No 485 (New Zealand) Sqn roundly rejected the FFS because it hindered their movement in the cockpit, especially when turning to see behind them.[19] Since it was acknowledged that RAF fighters could already outmanœuvre their German counterparts, the entire question of operational need for anti-g protection was now thrown open.[20] It also dawned on RAF administrators that new tactics would be required to capitalise on the suit's technical advantages.

Having withheld the FFS from combat for more than a year, this oversight seemed a staggering dereliction in high-level planning. Indeed, the only RAF unit to devise FFS-specific tactics was Burma/India-based No 17 Sqn, which naturally focused on highly manœuvrable Japanese types: "You have got a good tactical defensive device against enemy fighters," noted the squadron's combat manual, "[but] don't . . . be led into dogfighting at speeds lower than 250 m.p.h. [400km/h] or g lower than 5, or a height lower than 15,000ft [4,600m]".[21]

Over France, however, 2TAF faced entirely different operational circumstances. Once the April Fool's Day deadline passed, three Spitfire LF.IXB units commenced operations with the FFS Mk III. Responses from No 66 Sqn, plus the Norwegian Nos 331 and 332 Sqns, were rapid and unambiguous. While some pilots acknowledged that the suit might reduce fatigue and assist with dive-bombing, most found it impractical, detrimental and unnecessary.[22] "The FFS is very uncomfortable on the ground as well as in the air", asserted Sergeant Annæus Schjødt of No 331 Sqn; "It impedes the movements in both cases, [and] the very slight g protection it gives is in no proportion to the inconveniences which are felt while wearing it".[23]

Thus by late May 1944, RAF planners realised that they owned several thousand unwanted

ABOVE ***The FFS Mk III was deployed by the FAA mainly for use by British Pacific Fleet pilots of American types with larger cockpits than their British counterparts, including the roomy Vought Corsair. The FFS was not universally loved, however, with one pilot stating: "I hated the Franks suit. It was cold and clammy and always made me want to piddle after half an hour's flying".*** PHILIP JARRETT COLLECTION

RIGHT ***The American G3 anti-g garment was used by the USAAF from September 1944 and incorporated a pneumatic system rather than the "hydrostatic" system of the Franks suit. Eschewing the CAAG's gradient-pressure system, the G3 (seen here is a G3A) directed pressure only to essential bloodflow areas.*** NASM

anti-g suits. Urgently cancelling orders, they optimistically wondered whether Australian, American or Admiralty flyers might like the surplus outfits. At this very moment the RAAF was equipping Spitfire VIII pilots in Nos 452, 548 and 549 Sqns with improved CAAG suits; yet a few months later the latter were abandoned without ever seeing combat. Limited operational experience with the FFS during Operation *Overlord* confirmed that American pilots much preferred their own air-operated G2 and G3 suits. These rejections left just the Admiralty as a potential Franks Suit customer.

THE ADMIRALTY STEPS IN

As it happened, the FAA remained convinced of its benefits.[24] During February–June 1944, 65 Seafire L.III pilots of No 3 Naval Fighter Wing tested the outfit in operations. In contrast with their RAF counterparts, they agreed that its advantages outweighed the inconveniences. Operating from Lee-on-Solent, Hampshire, after D-Day, Lt R. "Mike" Crosley was bounced over France by several Focke-Wulf Fw 190s. "I retired up-sun for a second or two in the steepest turn I've ever made, but not blacking out, thanks to the g-suit", he enthused in his diary.[25] With 1,407 examples already delivered, and 3,293 on

1 M.C.C. Cotton to RCAF Overseas Headquarters, December 6, 1943, Library and Archives Canada (LAC) ref RG24 5361 45-2-18 Part 2
2 Allen, P., "The remotest of mistresses: the story of Canada's unsung tactical weapon: the Franks Flying Suit", *CAHS Journal 21* (1983), pp110–21
3 Air Ministry Pamphlet No 141. The Franks Flying Suit – Mark II (Air Ministry, 1942), p2
4 Jensen, F.W.M., "Questionnaire on hydrostatic suit", July 28, 1941, UK National Archives (TNA) ref AVIA 15/1464
5 "Meeting to discuss fighter strength as affected by the Frank Suit [sic]", October 27, 1941, TNA AVIA 15/1464
6 "Pilots' reports on Franks Flying Suit", November 24, 1942, LAC RG24 5361 45-2-18 Part 1
7 W.S. Douglas to Under Secretary of State, Air Ministry, November 23, 1942, TNA AIR 20/5193
8 Smith, G., "The Franks Flying Suit in Canadian aviation medicine history, 1939–1945", *Canadian Military History 8* (1999), pp35–41
9 Jenkins, D.R., *Dressing for Altitude: US Aviation Pressure Suits – Wiley Post to Space Shuttle* (NASA, 2012), pp72–109
10 Hobbins, Dr P., "Engineering the fighter pilot: aviators, anti-g suits, and Allied air power, 1940–53", *Journal of Military History 84* (2020), pp1095–1131
11 Cotton, M., "The development of the anti-blackout suit in World War Two", February 28, 1997, Royal Australian Air Force Museum
12 Air Ministry Pamphlet G.3089, "Provisionary notes and instructions – Franks Flying Suit", c 1944, TNA AIR 51/317
13 Wright, A.J., "Report on Franks Flying Suit", January 2, 1944, TNA ADM 1/13517
14 Pearson, R.B., "Franks Flying Suit", November 10, 1943, TNA ADM 1/13517
15 Naval Air Stations Secret and Confidential Weekly Orders 61/43, December 1943, TNA ADM 1/16438
16 Air Ministry to MAC, June 4, 1943, TNA AIR 20/5193
17 J.R.A. Peel to Air Commander-in-Chief, Allied Expeditionary Air Force, February 26, 1944, TNA AIR 20/5193
18 J.R.A. Peel to ACAS (Ops), February 12, 1944, TNA AIR 20/5193
19 Hume, M., "Report on Frank's [sic] Flying Suits by 485 (New Zealand) Squadron", January 26, 1944, TNA AIR 51/317
20 "Policy — Franks Flying Suit", November 22, 1943, TNA AIR 20/2134
21 Cotton, M.C., *Hurricanes over Burma: the Story of an Australian Fighter Pilot in the Royal Air Force* (Titania Publishing, 1988), p309
22 Cellars, J.R., "Report on trials with Franks Flying Suit Mk III on 132 AF in No 2 TAF", May 14, 1944, TNA AIR 51/317
23 "No. 331 Squadron", c May 1944, LAC RG24 5361 45-2-18 Part 2
24 *Victorious* to Admiralty, May 5, 1944, TNA ADM 1/16438
25 Crosley, R.M., *They Gave Me a Seafire* (Pen & Sword Aviation, 2014), p122
26 Lightfoot, G.L.S., "Frank's [sic] Suit", June 12, 1944, TNA ref AIR 20/5248; Markinson, C., "Service trials on Franks Flying Suit", August 8, 1944, TNA ADM 1/16461
27 Bazeley, H.F., "Franks Flying Suits", November 12, 1944, TNA AIR 20/5193
28 T.M. Williams to AIS3, September 28, 1944, TNA AIR 20/858
29 Lt-Cdr Charlton, "Experiences with safety equipment", c March 1945, LAC RG24 5361 45-2-18 Part 4
30 Rood, G., "A brief history of flying clothing", *Journal of Aeronautical History 4* (2014), p28
31 S. Davidson, "Report on visit to 2nd TAF", May 7, 1945, TNA AVIA 13/658

order, the Admiralty agreed to absorb some of the excess RAF production "until such time as a lighter, more comfortable and easily donned suit can be developed".[26]

Naval use continued through late 1944, while the RAF ordered that 2,000 stored examples be "reduced to produce".[27] Although at least five FAA Franks suits were lost over German-occupied France and Norway, the Admiralty urged the Air Ministry to keep it secret. Anti-g protection, it argued, would offer a critical advantage against "the fanatical habits of the Japanese and their willingness for self-destruction".[28] Less restrictive to wear in larger American cockpits, the FFS Mk III was allocated to Hellcat and Vought Corsair squadrons deploying with the British Pacific Fleet.

The FFS remained a mixed blessing in sweltering Indian and Pacific Ocean conditions. Although Corsair IV pilots of No 1834 Sqn "had to be completely convinced of its advantages to suffer the almost unbearable discomfort," noted their commanding officer, "90 per cent of the pilots wore them for all operations of which they had sufficient notice". Indeed, he added, "I personally am convinced that the enervating climate lowers the pilot's g-threshold, and that the FFS is essential to raise this threshold to a point where the full potentialities of the aircraft can be achieved".[29]

Nevertheless, the future clearly lay with inflatable suits. Yet despite their lighter and more flexible design, fundamental problems of operational need and aviator resistance remained.[30] When the new air-operated RAF Type II suit was demonstrated to 2TAF pilots in April 1945, the latter were "extremely sceptical — the more so amongst those who had already flown with the FFS".[31] It was a sad legacy for an innovative idea that had been defeated by trenchant pilot preferences, changing operational circumstances and extremely questionable policy choices.

ACKNOWLEDGMENTS *The Editor would like to thank Phil Vabre for his help in bringing this feature to fruition*

LT-COL FERN VILLENEUVE, AFC

hawk one

PART 2: THE GOLDEN HAWKS & BEYOND

NICK STROUD

ABOVE ***Joseph Armand Gerard Fernand "Fern" Villeneuve at Lee Bottom Flying Field, Indiana, in 2005. Fern was a keen lifelong aviator and a regular visitor to clubs and events, as evidenced by his never-without baseball cap representing the "Tiger Boys" vintage-flying organisation of Guelph Airpark, Ontario!***

In the first half of our interview in *TAH31* with distinguished Canadian aviator ***Lt-Col FERN VILLENEUVE***, who died aged 92 in December 2019, he described his first ten years in aviation, including his first solo, his RCAF training and his posting to Europe as a Canadair Sabre pilot. We pick up the story in 1958, with Fern back in Canada as an instructor at the Central Flying School in Ontario . . .

LATE IN 1958 there were rumours flying around that there was going to be an RCAF aerobatic team formed, the equivalent of the USA's Thunderbirds or Blue Angels, where pilots would be assigned only that and not as a second job. While I was at Training Command, there were some unfortunate accidents involving formation aerobatics in our Sabre operations, so these were prohibited altogether from around 1955. But our Chief of the Air Staff [CAS — at that time Air Marshal Hugh Campbell] was a believer in the public benefit of having an aerobatic team, and 1959 marked the 50th anniversary of the first powered flight in Canada.

Nick Stroud: John McCurdy and the Silver Dart?

Yes, at Baddeck, Nova Scotia, in 1909. So it was to celebrate that, and of course 1959 was the 35th birthday of the RCAF. So the CAS convinced the RCAF Air Council and Ministry of National Defence to authorise a team. I thought, how can I get into this? I couldn't find any information, but somebody who was up in headquarters who knew of my past said we should check out this

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guy because he's done all this before. I wasn't the only one, but they were looking for someone to lead the team.

I went to work one day and my flight commander said there's a wing commander coming from Ottawa and you are to go and see him at Training Command HQ at two o'clock this afternoon. So I made myself available to meet Wg Cdr [John] Buzza, who had been a Sabre pilot at one time. He was in the RCAF project office and tasked with forming the team. He opened up these drawings and showed me the paint scheme that was to go on the Sabres. He divulged to me all of the planning, the name for the team — Golden Hawks — and everything else and wanted to know my experience; flying times and everything else. I said "I'll volunteer to fly any position on this team that you're forming". And he said, "My job is to interview people from which a leader will be selected, and it'll be the leader's job to select his team". I said, "OK, but put my name down to fly". He said, "Right now I'm only looking for a leader — will you do that?" and I said "Absolutely!"

About a month and a half went by and I was wondering what was happening with it.

ABOVE ***One of a series of superb colour photographs taken by RCAF Cpl George Hardy not long after the formation of the Golden Hawks in the spring of 1959, taken from the open side door of an RCAF Canadair North Star. Interestingly, Fern recalled that he was initially allocated an RAF exchange officer as liaison between the team and Air Defence Command HQ.***

I came into work one day again at the CFS at Trenton, where Training Command HQ was on the other side of the road. The CFS's wing commander said, "You've got to go and see the AOC [Air Officer Commanding]". I thought "What have I done now?" He just said, "See the AOC tomorrow morning at nine o'clock, and be dressed in your best uniform".

So I did. I went into the headquarters and I had heard so little, I really had no idea. I kept my fingers crossed and hoped that the team was what it was about. I remember there was a secretary sitting in a little office. I said, "I'm Flt Lt Villeneuve". She went into this office and came out and said, "The AOC will see you". She opened the door and I looked in this office — it was the longest office I had ever seen — and at the far end, behind a great big desk, was Air Vice-Marshal [J.G.] Bryans, AOC of Training

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ABOVE ***The Golden Hawks at Chatham, New Brunswick, beside one of the team's Sabre 5s before the start of the inaugural cross-country tour in May 1959. From left to right: Fg Off Bill Stewart; Fg Off Ed Rozdeba; Flt Lt Jim McCombe; Sqn Ldr Fern Villeneuve; Flt Lt Jeb Kerr; Flt Lt Ralph Annis; Fg Off John Price and Fg Off Jim Holt.***

Command. I stepped through the door and saluted. He said, "Come up here, young man". I walked up to his desk and he stood up and shook my hand and said, "Congratulations, I've just been advised that you've been selected to lead the Golden Hawks". [Big sigh] So I thanked him and he said, "You will get your instructions from Ottawa, Wg Cdr Buzza will advise you. I will advise your OC at CFS that you are on a roaming commission to do whatever you need to do to develop this, until such time as your official transfer comes through. It will have priority over your duties at CFS".

I received instruction that the F-86s were in storage at Mountain View in Ontario. My first task was to go there and test fly the Sabres that were being brought out of storage. They wanted the team on Sabre 6s, which were lighter and more powerful, but there weren't any available in Canada, they were all in Europe, so they said the team will be on Sabre 5s. Its mandate was for one year and was to disband at the end of September 1959, which it did.

I test-flew the aircraft, and if they were acceptable, flying-characteristics-wise, I was to land them at Trenton, where they were to be painted and have a smoke system installed. They all had a slight variation in c of g [centre of gravity] and if it wasn't exactly in the right place, when you got close to a stall the thing would tend to "dig in" on its own. It never went very far but it was comparable to the phenomenon we later called pitch-up. It happened so close to the stall that it didn't matter, but it just gave you that little "digging in", as we called it. So if a Sabre did that I didn't want it in a formation.

My next task was to go to Chatham in New Brunswick, where all the Sabre-flying in Canada was taking place — except for one at CFS for maintaining currency on the Sabre. So they had the personnel section at Air Defence Command (ADC) headquarters canvass the staff at the OTU [Operational Training Unit] to get the names of anyone who wanted to volunteer to be on this team. Amazingly, the list comprised less than 50 per cent of the staff. The personnel people then went through their files and if a particular individual was considered maybe not desirable in the public eye, they took him off. They gave me the remaining names and said, "Here are your volunteers".

I interviewed everyone who wanted to be on the team and then I'd brief each one of them and take them flying in a Sabre in formation. Of course, I got people who had some experience and some that didn't have any experience.

At that time the team was specified to have a formation of four and a solo. I called Buzza in Ottawa and said, "You're allowing me to take six aircraft on the road; I'd like to take seven and fly six — do you suppose we can get authority to do that?" He said, "I think so, I'll let you know tomorrow". He called back and said, "That'll be OK". So now we decided on a four-'plane formation and two solos; ADC had a lot of pilots that had gained experience in

TAH ARCHIVE

ABOVE ***A contemporary promotional pamphlet for the 1959 Golden Hawks tour, detailing the pilots (and their airshow "voice" Fg Off George MacDonald, who travelled with the team as full-time commentator). Despite some initial grumbling in the air force's higher echelons, the Hawks proved extremely popular with the Canadian public.***

those early years in Europe with those aerobatic teams. *[See Part One in* TAH31 *— Ed.]*. A lot of those people were now doing a ground tour as radar controllers at a GCI [ground-controlled interception] site, vectoring interceptors on to targets, but they refused to allow any to be taken off their assignment to go on the team. So Training Command said, "Well, we support this programme, we will supply the pilots. Do you have any names?". I said that I knew people who had experience; Ralph Annis, he would be an asset to the team. They got a couple of other volunteers — [Fg Offs] Bill Stewart and Jim Holt. They were sent to Chatham, as was Sam Eisler.

We started practising the formation routine in an off-spot about 20 miles [30km] from the base; the solos did likewise in another direction about 15–20 miles away. It worked fairly well and we did a couple of practices. The base agreed to shut down training at four o'clock every day, so the aerodrome was ours from 1600hr to 1700hr to practise right over the field. We managed to get three or four practices in there before Sam had his unfortunate accident.

NS: What happened?

FV: He and Ralph were doing this co-ordinated loop. They were coming in from opposite directions. They would start to pull up and they would cross; by the time they were at about 30° of climb angle they would cross with, of course, some separation. Over the top, to maintain the illusion, they couldn't cross side by side — they had to cross one above the other. And so they crossed side by side on the way up, one above the other over the top, and then crossed again side by side on the way down. They were practising this manœuvre; Annis came out and looked for Sam and there was nothing but a plume of smoke coming out of the bush. We had lost Sammy. They never determined what had gone wrong. He may have had a failure, a distraction, a bird or anything — but there was no evidence of anything. We felt that the manœuvre was not performed too low, because Sam was the guy that crossed on top. There was enough room for Ralph to come over without any trouble, so there should have been lots of room for Sam to do the same.

NS: Did you at any point think that that was going to jeopardise the team?

FV: We had only been a couple of weeks in being. I didn't realise it at the time, but in the years that followed I realised how much objection there had been to this activity. There were people who were die-hard devoted to the RCAF, Air Force people, and yet they weren't in favour of this. Mind you, it was putting the Sabre in the limelight and there always seemed to be some rivalry between the [Avro Canada] CF-100 crews and the F-86 crews. Some jealousy maybe too. So part of it came from that side of the house. Anyhow, we survived the

DND

ABOVE ***Being a member of the Golden Hawks led to some unusual duties, which in June 1959 included posing for publicity photographs on the port wing of a Sabre with Hollywood movie star and swimming champion Esther Williams at RCAF Station Uplands in Ottawa. Fern looks on bemused at far left.*** **BELOW** ***The Hawks' 1959 patch.***

accident and John Price stepped forward and volunteered. He hadn't been a volunteer from the beginning, but he said he wanted to do it, so we flew with him and he was acceptable. He replaced Sam, and we had our six-'plane again. Bill Stewart and Jim Holt were sent to us as standby pilots and commentators and to supplement the team whenever needed. They eventually ended up flying in the show because they were both qualified Sabre pilots, and good ones too.

The formation, equipping and training of the team was under ADC, but the tour — the Golden Hawks Tour — was under the supervision of Training Command. So once we finished our training, we had March, April and about half of May [1959] to tighten everything up. We put a show together and went to Ottawa to demonstrate it. Then we went to Training Command, which was in charge of logistics, transport and everything for the Golden Hawks Tour. Our base moved from Chatham to Trenton. We had a road team but we also had a maintenance group, so that when an aircraft needed an inspection, we would fly it in and take another out.

We had a small crew at Trenton that did inspections for us. They even moved the crew to Saskatchewan when we were out west, but after the first year it was realised that it was not necessary, it was more trouble to move them to Saskatchewan than to bring the Sabres back to our base at Trenton.

NS: Throughout that summer of 1959 the Golden Hawks were a huge success.

FV: Well, we believed in this — we talked among ourselves — it behoves us to make this so successful that it becomes a permanent team in the RCAF. We think Canada deserves this; Canadian pilots deserve some recognition, not just the Thunderbirds and the Blue Angels — so we worked hard at it. We got a lot of public and press support. At the end of September we had finished our tour and we ended up at Trenton. We had a disbandment parade and we were to be scattered to the winds. But the CAS said he wanted to keep the aircraft and pilots together until he could get authority, because he was going to request the Hawks be reformed.

Had it not been for him, the team would have never been formed to start with. He got permanent approval, so although it disbanded in September 1959 it re-formed again on March 1, 1960, with the same pilots, but as a permanent team. I was briefed that I was to train my replacement to lead the team in 1961.

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ABOVE ***In the summer of 1959, having seen an American magazine cover with the US Navy's Blue Angels flying over Niagara Falls, Fern insisted on going one better by having the four-Sabre formation photographed by George Hardy and his cumbersome Speed Graphic 4x5, this time in a T-33, over the Falls — inverted with coloured smoke.***

NS: Was it your decision that you didn't want to continue with it or did they say "We want to get new blood in"? Did you elect to leave?

FV: Oh no, I would never had elected to leave the job — I thought it was great. But you can't do this all your life, and the idea is to rotate pilots. You replace half the pilots every year — that provides you with the new blood and it provides continuity. But because we started in '59 and did it again in '60, they said in '61 we will replace half the team. Half of us on the team were married and the other half was single. They said the single pilots will stay for the continuity and the married ones are going to be transferred out. There was no argument, so John Price, Ralph Annis and I were transferred off the team. But I had to train Jim McCombe to lead the team on my departure, and John and Ralph flew with other pilots that had volunteered.

NS: Did you find that being lead was easier than being box- or wingman? Or do they all have their different challenges?

FV: They do have different challenges — I wouldn't class one easier or harder; you really are a team, you're even more closely related than if you're married! You have to have complete trust in everybody and they have to have complete trust in you. The leader is the one with the big responsibility because if you miscue something it can have fatal results. But the actual tasking was just as hard. I enjoyed all of it and I'd do any of it, whether it was solo or formation or whether it was just flying in the formation or leading it. Always enjoyed it.

NS: After handing over to Jim McCombe at the end of the 1960 season, where did you go from there?

FV: Well, I had an unfortunate aircraft accident about that time.

NS: What happened in that accident? [November 7, 1960 — Ed.]

FV: Jim McCombe and I were doing a night formation trip from the OTU at Chatham. He was the new assigned leader of the Hawks and I was awaiting my next assignment. We had a cloud base of about 2,500ft [750m], tops about 20,000ft [6,000m]. So we were doing penetration and instrument exercises with a GCI crew.

NS: Was this in Golden Hawk Sabres?

FV: No, we were flying Chatham Sabres because at that point they were retiring the Sabre 5 and Jim McCombe, as the newly assigned leader, along with his two remaining members, Ed Rozdeba and Bill Stewart, went to Europe to bring back Sabre 6s for the team, as there were none in Canada.

TAH ARCHIVE

ABOVE ***In September 1959 the Golden Hawks team was officially disbanded, and Fern was posted to the OTU Tactics Flight as an instructor, where he flew Sabre 5s, as seen here. The Hawks had proved so popular, however, that the team was re-formed for the 1960 season, Fern completing his second and final season as the team's leader.***

Anyway, I was leading. I led the first penetration up, down, a low approach and overshoot. I was going to climb up again and hand over the lead once we were on top in the clear. But on the overshoot we were on the east–west runway in Chatham; it's not the biggest city in New Brunswick, but Newcastle was right at the end of the runway. We were on the overshoot when my engine failed — the thrust-bearing went. It was a bit of a problem in the Orenda.

Of course what happens then is the whole turbine shaft and compressor shifts forward, having nothing to hold it back. And the rotating blades in the compressor start to chew the static blades. I would have never believed the amount of deceleration you feel all of a sudden. There was a muffled "phmff" and the Sabre felt just like somebody had thrown the brakes on.

I looked at the instruments in disbelief and said, "I've got engine failure and I'm baling out". I put my feet ready to go and I looked up and there were all the lights of Newcastle. And I said to myself, "You can't do this, you've got to live with whatever happens". So I put my feet back on the rudder pedals and said I'm going to turn this thing around. Just then we hit the cloudbase, so I stayed underneath the cloud and looked at everything. The engine was turning over but the exhaust temperature was up off the clock, so I throttled back. I could bring the temperature down to the limit, which was 690°C; the gauge only went to 1,000°C, so anywhere between 700°C and 1,000°C, I could bring it down to 700°C. And I nursed the Sabre around to a downwind position, because we'd just overshot the runway. So then I came on the RT and said I'm going to try and bring this in, because I don't want to get off here. *[According to the citation for the Air Force Cross he was awarded as a result, his last transmission was "I can't leave now . . . it's pointing at the houses" —Ed.]*

NS: You made a turn away from Newcastle . . .

FV: Yeah, but when the failure happened we must have been doing about 350kt, so I had some momentum, plus I am getting some thrust out of that engine. So I roll out on a downwind leg and there's the runway all lit up. Every time the exhaust temperature went up I'd bring it back down to 700°C; I looked behind me and there were sparks flying out of the tail because metal was grinding metal. It was going through the flame tubes and out the tailpipe but I thought I'm OK. This had been done before, so I think, well maybe I can make this. What happened then is that I'm starting to turn base when I realise that I'm low enough that if I put the gear down, the extra drag, combined with the steeper angle, means I'm not going to reach the runway. So I decided to go wheels-up on to the runway, which is less catastrophic than landing wheels-down out in the bush.

I turned final. We found out later that the exhaust temperature went up to the limit, and I tried to pull the throttle back, but by now I'm

TAH ARCHIVE

ABOVE ***A publicity shot of Fern around the time he was leader of the Golden Hawks, with which he performed more than 130 displays during 1959–60.***

against the idle stop. I thought "Well, I can't go back anymore" and the temperature still went up because fuel's still going in there and there's a fierce fire in the engine. We had two fire-warning lights: an amber light, meaning a fire in the tail section, and a red light, meaning a fire in the forward compressor area. The routine was that if that red light comes on you've got a second and a half to get out. Well, both lights came on. I cut the fuel off while still turning to land. The engine just stopped right there. I'm on the alternate control system operating off the battery to an electrically driven hydraulic pump, to provide hydraulic pressure to operate the controls. The ailerons and elevators were fully hydraulic, but the F-86 rudder was straight cables, just like a Tiger Moth. I'm approaching the flare point but I've got a steep angle, and to flare required a great displacement of the tailplane hydraulic actuator to move the elevators to their fully up position. In the process of doing that the hydraulic fluid required by the actuator exceeded the output of the pump. What happens then is that you lose all your pressure — and I lost the pressure halfway through the flare.

So now I'm not completely flared, the Sabre hits the ground and bounces and I'm rolling to the left. I had no ailerons, so I firewalled the right rudder pedal, raised the right wing just before it stalled, and then it just went "kerplunk" on to the runway. I suffered fractured vertebrae. Because I didn't bale out over the town and let the Sabre crash there, someone took recognition of that and recommended me for an Air Force Cross *[awarded on July 6, 1961 — Ed.]*.

NS: How long were you out of action for?

FV: I was in the hospital for about a week and they put me in a body cast. I could walk around in this body cast, but it was from my neck to my toes. It led to some problems later on, because I was in the cast for three months and my muscle flexibility sort of went, so I had to exercise and have physiotherapy.

NS: How long before you were fit to fly?

FV: I was flying again by March 1961. At this point I had been transferred to my new assignment as a safety officer for ADC. It was an interesting job; it wasn't flying but it required me to stay current. So I flew CF-100s, F-86s and T-33s. During my tenure in there, we introduced two new interceptors into the RCAF inventory — the [Canadair-built Lockheed] CF-104 and [McDonnell] CF-101. I went and flew the '104. I had two captains working for me in the safety office and one of them went and flew the '101 so we could speak with some knowledge about the aircraft whenever it had an incident or an accident. So I was in that assignment for about four years, and then at the end of that I was assigned to go to a '104 squadron. I went to the OTU at Cold Lake, took strike training and then went to Europe as the CO of a CF-104 squadron in Germany for three-and-a-half years.

NS: Which squadron?

FV: No 434 Sqn at Zweibrücken. We had six strike squadrons in Europe in 1965 when I went over there. In 1967 the government cut back our nuclear-capable squadrons from six to four, and disbanded No 434 Sqn and the one at Baden. I'd only been there for about a year and four months; my tour was not expired so they had to reassign me. The Base Operations Officer was tour-expired so he was coming back to Canada. They took the senior squadron commander at Zweibrücken and made him the Base Operations Officer; he happened to be the CO of No 430 Sqn so they reassigned me as CO of No 430 Sqn.

So I was CO of No 434 Sqn for about 16 months and then I moved over to No 430 Sqn for two years. I certainly got a little bit of luck there, because they decided to close the base in the summer of 1969 and they weren't going to send a new CO to the squadron, so I whipped in. My tour was extended by about six months; I ended up spending about three-and-a-half years in Germany.

Built under licence by Canadair, the CF-104 Starfighter entered service with the RCAF in late 1962 to equip eight squadrons in Europe for the nuclear strike/ reconnaissance role. This example, serial 12854 of No 441 Sqn, is seen at the Paris Air Show in 1965 with its anti-flash white upper wing surfaces and ventral reconnaissance pod containing four Vinten cameras and electronic sensors.

MIKE STROUD / TAH ARCHIVE

NS: What was the daily routine for an RCAF CF-104 squadron at that time?

FV: There were some exercises, bombing practice of course. We had a dispenser under the '104 that would carry six practice bombs that had a trajectory very similar to the actual bomb that we would have been using in hostilities.

NS: That would have been a nuclear device?

FV: It was, and they were in American custody. Canadians did not have any custody of these weapons. It was a good programme, because neither nation could launch these weapons without each other; the bombs couldn't go without the aircraft and the aircraft had no business going without a bomb, because they had no other armament. So it required the agreement of both the Canadian and American governments before we would ever go to war. We were there as a deterrent.

We had an aircraft that had acquired a bad reputation, but it was fantastic as far as I was concerned. It was so little that it had a very low radar signature. We did our flying at 500ft [150m] and 540kt, and, by the time the radar picked you up, you were already overhead. Before it could get you again, you were gone.

So we felt rather confident that we would get away with it and we could deliver this thing on target. We developed some great techniques in visual bombing and radar bombing. Our device was a retarded bomb; you couldn't toss it because once it left the aircraft it had a parachute that deployed. You could get much further from the blast if you kept going the same way. So what we did was approach the target at very low level to escape radar; we had tables that gave us the distance travelled during the pull-up, release height and how far the bomb travelled after release. We took all these distances into consideration and calculated a distance at which we could start to pull up. We practised this pull-up because it was an application of full afterburner; 4g; 45°; stabilise; wait for the bomb-release to come up. Then you rolled over on your back and pulled the nose down 45° before rolling level at 800ft [250m] because the bomb was set to detonate at 800ft above ground level. A ground-impact detonation was the dirtiest thing you could do, because it would throw all kinds of radioactive dirt and material into the air. But at 800ft the blast would level everything. There would still be radioactive material thrown up, but it would be kept to a minimum. We figured we could escape the blast because the bomb would be released at about 4,000ft [1,200m], and by the time it went off at 800ft, you could be about two miles [3km] away at the same height.

I came back to Canada in the summer of 1969 [as a Wg Cdr] and I was sent to Staff College, where I spent a year, after which I was assigned to a CF-100 electronic warfare squadron [No 414 Sqn], which I led for two years. The idea of this was to present an ECM [electronic countermeasures] environment for the ground radar so that they could learn to operate with countermeasures.

NS: What did that involve?

FV: The CF-100 was loaded with ECM equipment and chaff dispensers. We flew out of places like Frobisher Bay [now Iqaluit Airport] and Fairbanks, Alaska. We went to Anchorage one year. We would fly out of Goose Bay in Labrador, and American bases — Orlando in Florida or McChord in Washington state or some places down in California. Our exercise was always a night one. We would depart the base and go out unannounced to the ground radar. We assigned routes with a control monitor who knew that we weren't real enemy aircraft. Many exercises we did over the Atlantic. We would fly to Bermuda, sit there until the next night, when we would

MIKE HOOKS

In 1970 Fern joined No 414 Sqn, based at RCAF Station St Hubert in Quebec, which operated Avro Canada CF-100s in the electronic warfare role. This rather weary No 414 Sqn CF-100 Mk 5, serial 18776, seen here in the summer of 1967, was one of those used by the unit for electronic countermeasures calibration and training during Fern's tenure as CO from 1970 to 1972.

leave, fan out north and south and then start towards Washington DC with our ECM gear and everything else going.

NS: You were testing the American defences, see if they could pick you up?

FV: Yes, see if they could pick us up, using their ground radar, which we would jam as best we could. They would cut through this jamming and direct an interceptor towards us.

Many times I remember being 400 miles [650km] from the coast over the water and the radar operator in back saying there's an interceptor on us. He had radar receivers, and, knowing the frequencies of ground and airborne radars, he could tell what he was receiving; whether it was from the ground or an interceptor. He'd have a direction finder and he'd say, "He's coming from the right". We'd look up and, would you believe, there were nights when I'm at 38,000ft [11,600m], 400 miles off the east coast of the USA and there's a [Convair] F-106 Delta Dart out there with this one pilot in a single-engined thing way out there. We tried to jam the heck out of them. Sometimes we succeeded; most of the time *they* succeeded.

NS: They didn't know who you were; did ground control let them know?

FV: The ground controller was not aware of the exercise; all of a sudden he picked up these aircraft coming in. He would then declare an unidentified target and position and pass it over to the referee, who says, "That's one of ours, OK. Your unknown is identified, in the game". So he scrambles a fighter on it and tries to direct that fighter. We've now got a cat-and-mouse game going on where we're trying to jam the frequency of his radar; he would change the frequency, clear the scope and then try to identify us. As soon as he did this of course we would find out he's not on us and the operator in back would say, "He's gone".

If the fighter got to us at a particular angle and distance we dropped him a bundle of chaff and hoped he locked on to that instead of us. It was great because it trained our defences to operate in an environment that the Russians would certainly use — electronic countermeasures.

After my two years with that squadron I was reassigned to headquarters as a Chief Accident Investigator. It was quite a large division and I had ten investigators. I was deputy to the Director of Flight Safety [DFS] and supervised the investigation side; there was an accident-prevention team on the other side.

NS: Did you want to be doing a desk job then?

FV: I didn't have much choice. I'd had so many great flying assignments I couldn't complain. But safety was of great interest to me. It allowed me to fly. I flew T-33s, flying at targets for the radar. They required some manning to do this job and people on desk jobs could do it. It was interesting because the investigator would call and say, "We've recovered the wreckage, dug it out of the hole, and we've got the fuel-control unit from that engine that quit in the air and we don't know why. We're going to dismantle it to see if there's any malfunction in there". I would say "Hang on, don't you touch it. I want it X-rayed before you dismantle it in case there's something hung up in there". So I considered myself kind of "mother", monitoring these activities to make sure they didn't miss a step.

I ended up doing that for four years. I was there from 1972 to 1976 and then I said I would like an operational assignment. They said, "How would you like to be a Base Operations Officer?" Either Cold Lake or Bagotville. I would have preferred Cold Lake, but because I have some knowledge of French I ended up at Bagotville, where I went in 1976. In the DFS

LEFT ***Fern and his wife Lynda at a prestigious event in June 2005. After his retirement from the RCAF Reserve in 1992 Fern accrued more than 3,800 flying hours as a glider-tow pilot, completing some 20,000 tug flights for the Air Cadet League training programme. He was also a regular visitor to vintage flying events in Canada and the USA in his Globe Swift, C-GLYN.*** TAH ARCHIVE

job I had managed about 100 hours a year of T-33 flying. I went to Bagotville at a time when we had a shortage of pilots in the RCAF. They had the OTU there for the CF-101 Voodoo, and while I was Operations Officer I was responsible for managing the combat centre — scrambling interceptors and the various codes of alert and all the handling of missiles, quick reaction alert [QRA] and everything else. I put in a request to the base commander, "Any chances of me getting experience in the '101? I haven't flown one". When I was a safety officer at ADC some 14 years earlier I had introduced the Voodoo into the system as a safety man. At the time I was told I should probably fly it but I was busy with the CF-104.

So I said I would like the opportunity to fly this aircraft, which would increase my knowledge as commander of the combat centre. He said, "Draft a message and we'll go to headquarters and if they approve it you're in". I put in a request and it came back approved because, as it happened, the OTU was awaiting its next course. They only trained four pilots and four navigators every three months to replace crews on Voodoo squadrons. They only had one pilot for this course, so they approved me to be on it. The irony of it all was when the course started I was the only pilot there because the young lad who was due to take it got appendicitis and had to be hospitalised. So I took the course and finished it. I enjoyed the Voodoo very much.

Fern

CHARACTERISTICALLY, Fern managed to wangle his way into flying the Voodoo on a regular basis while at Bagotville, where he remained until reassigned to his last full-time RCAF post as a Base Administration Officer at North Bay, Ontario. The indefatigable Fern finally retired from the Air Force in 1982, having accumulated more than 13,000 flying hours over the course of a remarkable 32-year RCAF career.

Ever determined to foster the development and education of young pilots, Fern joined the RCAF Reserve the following year in order to support the Air Cadet Training programme, and became the Operations Officer of the Central Region Gliding School. His decade-long tenure there saw him update training standards for the programme and, although he retired from the Reserve in 1992, he continued to offer his invaluable experience, as a civilian instructor with the Air Cadets for another ten years.

In 1997 Fern was accorded a remarkable honour when he became one of only two living people to have their image emblazoned on a Canadian coin (**INSET, BELOW LEFT**) — the other is Her Majesty Queen Elizabeth II. Another shining accolade came in May 2006, when he was inducted into the Canadian Aviation Hall of Fame.

Fern continued to maintain his keen interest in all things aviation and became a valued adviser on the restoration project established by Vintage Wings of Canada to put a Sabre in Golden Hawks livery back in the air — which demonstrated at air shows across Canada for several years from 2009 — and was a regular vistor to airshows and events across North America, often with his Globe Swift, C-GLYN, registered in honour of his beloved wife Lynda.

From a personal perspective, Fern was eternally enthusiastic about flying of all kinds and some of my happiest memories are of flying with him — and he would fly literally *anything*. If a pair of wings was attached to a shopping trolley he'd be at the front of the queue to fly it. Beyond aviation, Fern was also a uniquely warm personality, ever-willing to chat and keen to accommodate others. My profound thanks go to Rich and Ginger Davidson at Lee Bottom Flying Field in Indiana for introducing me to Fern, and extending such generous hospitality for the interview back in 2005.

NICK STROUD

SWEDEN'S PARASOL FIGHTERS

THE FVM J 23 & J 24/J 24B

The Swedish FVM J 23 parasol-winged monoplane is one of the most obscure fighters of the interwar period — and with good reason. Only five were built, four of which were grounded after the first was lost in a fatal accident; and the sole J 24/J 24B developed from it was little better, as **JAN FORSGREN** reveals

DURING THE EARLY 1920s, only one type of fighter aircraft was operated by *Flygkompaniet* (Swedish Army Air Service) — the Phönix D II. A few fighters of indigenous design had been tested in the preceding years, with the Thulin K (essentially a copy of the French Morane-Saulnier Type N/*"Le Vengeur"*) and the Södertelge Verkstäder SW 15 being used in very limited numbers. However, with the Phönix D II being deemed obsolete, the decision was taken to design and produce a replacement at *Flygkompaniets tygverkstäder på Malmen* (FVM — Army Air Service Workshops) at Malmslätt in southern central Sweden.

The design of the new fighter was initiated in 1922 by Henry Kjellson in co-operation with aerodynamicist Ivar Malmer, with the aeroplane being tentatively designated J 22 (J for *Jaktflygplan* — fighter aircraft — and 22 indicating the year of construction). Work on the wing ribs and a spar for fatigue-testing was initiated on August 8, 1922, with two fuselages being ordered on October 22. Three sets of wings were ordered that December, with three more fuselages and sets of wings ordered the following month. One of the wings was to be used in static tests, which included having 42

The J 23 protoype, serial 3111, just after its rollout from the FVM workshops at Malmslätt in the early summer of 1923. Note the vestigial rudder attached to the fuselage sternpost, later replaced with a larger conventional fin and rudder after trials revealed directional stability problems. The J 23's BMW IIIa six-cylinder liquid-cooled powerplant was the German company's first aero-engine. VIA AUTHOR

ARLANDA CIVIL AVIATION COLLECTION VIA AUTHOR

ABOVE ***Swedish test pilot Georg Gärdin poses beside 3111 following his altitude record flight. Note the unusual slotted aileron of triangular planform on the port wing. British weekly* Flight *reported on the J 23 in August 1923 and explained that "as the aileron was moved up or down, the size of the slot did not change", unlike Handley Page's patented slotted aileron.***

people standing on the wing. Reportedly, the wingtips moved only "a couple of centimetres" during this particular test.

The design was, for its time, fairly advanced, at least when compared to other aeroplanes emanating from the FVM workshops. Built entirely of wood, the fuselage was of monocoque construction with veneer covering. The wings were fabric-covered. Although exhibiting rather elegant lines, it was somewhat anachronistic in having no fin, just a small vestigial rudder attached to the fuselage's sternpost.

The J 23 (as it was soon redesignated) was powered by one 185 h.p. BMW IIIa inline engine, and was armed with a pair of 8mm machine-guns. The price per unit was set at 24,000 *Kronor*.

PUBLIC DEBUT

The J 23 prototype first flew in June 1923 in the hands of test pilot Georg Gärdin. Assigned serial number 3111, the new fighter was displayed at the ILUG international air exhibition in Gothenburg in early August 1923, during which it reached an altitude of 7,314m (24,000ft), at that time a Scandinavian record. Reportedly, the head of the UK's Aircraft Disposal Company commented favourably on the J 23, apart from the curious absence of a fin. Although the flight and handling characteristics were deemed good, with a maximum speed of 197km/h (122 m.p.h.), the lack of a fin meant that the J 23 had insufficient directional stability. In the event, a fin and rudder were added, along with a slightly enlarged tailplane.

Four more J 23s were built (serials 3113, 3115, 3117 and 3119), although initially only one of them was assembled. In the event, all five J 23s were taken on charge by Flygkompaniet.

Testing, including aerobatics, continued. On March 15, 1924, test pilot Axel "Pippi" Norberg took off from Malmslätt in J 23 serial 3111 for a test flight to include diving trials. Owing to the small size of the cockpit, Norberg did not carry a parachute. At about 1030hr Norberg initiated a spin which, according to a contemporary news article, "quickly turned into a rapid revolving and irregular manœuvre, which was followed by a loud whirling sound". The port wing detached, landing some 2km (1¼ miles) from the main wreckage, with the parachuteless Norberg standing no chance when the J 23 impacted the ground at Tift near Malmslätt.

The press stated that upon hitting the ground, the fighter had turned into "fragments smaller than matches". The aircraft had accumulated 35hr in the air, with "certain stability tests" having previously been performed by Norberg.

Following the fatal accident, the remaining four J 23s were grounded and consigned to storage, where they remained until struck off charge in 1925 (3115 and 3117) and 1926 (3113 and 3119). Following Norberg's death, Swedish military pilots demanded that a parachute always be worn, particularly during test flights. It was concluded that the J 23's airframe, notably its wing and struts, were insufficiently strong.

Even before the accident, construction of

VIA AUTHOR

SWEDISH AVIATION HISTORICAL SOCIETY

ABOVE ***The prototype J 23, by this time fitted with a revised larger fin and rudder, takes off for a test flight. The original rudder arrangement was described by*** **Flight** ***as "ridiculously small by British standards . . . while the small control surfaces may be, and probably are, sufficient at high speeds, it is inconceivable that they can have sufficient power at or near stalling speed".***

LEFT ***The August 1923*** **Flight** ***report also expressed reservations about the J 23's handling characteristics, stating that a Swedish source had revealed that "spins frequently occur". Within seven months the J 23 had claimed a pilot's life, when Axel Norberg was killed in 3111 after a wing detached during an irregular spin.***

BELOW ***With a further modified fin and rudder of lesser area than the prototype's second configuration, the final production J 23, serial 3119, awaits a flight. The type's fuselage was of elliptical cross-section, constructed of three-ply panels over a light framework of stringers and formers. The thick wings tapered both inboard and outboard.***

VIA AUTHOR

VIA AUTHOR

"ALL OF A SUDDEN, I HEARD A LOUD BANG FROM THE FUSELAGE, WITH THE TAIL SECTION STARTING TO VIBRATE SO BADLY THAT I COULD NOT RETAIN CONTROL OF THE STICK. WHEN I TURNED AROUND, I NOTICED THAT THE FUSELAGE WAS BREAKING APART . . ."

ABOVE ***The third production J 23 (fourth in total), serial 3117, is seen here with the "low-cut" fin and rudder, suggesting that this was fitted as standard on the production models for their entry into service. The BMW IIIa engine was of the high-compression type and was capable of maintaining power up to considerable altitude.***

a strengthened J 23 had been initiated, with manufacture of one prototype being ordered on February 7, 1924. The new machine was designated J 24, with the basic configuration of the previous J 23 being retained.

ENTER THE J 24

The J 24 was powered by a 300 h.p. Hispano-Suiza engine, with Lamblin radiators located on the strengthened undercarriage legs. The cockpit was enlarged, with the pilot's seat having ample room for a parachute. One fuselage was ordered, along with two sets of wings, which were covered with a veneer rather than the fabric of the originals. The struts were also strengthened.

The J 24, assigned serial 4121, was ready by February 1925. Despite having a more powerful engine, the J 24 was more sluggish than its predecessor. Flying instructor Nils Söderberg was appointed chief test pilot for the J 24 following Norberg's death, and used a Heinecke automatic parachute, the envelope of which was attached to the aeroplane.

Unfortunately, the sole prototype did not last long, the fuselage suffering structural damage during flight. Söderberg managed to set the fighter down in one piece, and later recalled the event in his memoirs:

"During one of the diving trials, something happened which made me bless and then curse the damned parachute. All of a sudden, I heard a loud bang from the fuselage, with the tail section starting to vibrate so badly that

ARLANDA CIVILAVIATION COLLECTION

ABOVE ***Lieutenant Wilhelm Nernst beside J 23 serial 3119. Tragically, having survived flying the notoriously tricky J 23, Nernst was killed in a mid-air collision over Simtuna in September 1924, while flying a Phönix D III. After Norberg's death in 3111 in March 1924, the four remaining J 23s were grounded, so it is likely this photograph was taken in the second half of 1923.***

VIA AUTHOR

ABOVE ***The J 24B dispensed with the parasol-wing configuration, the J 24's damaged fuselage being repaired and used as the basis for a conventional biplane version. The latter was given the serial 5121 and, after flight testing, was handed over to test pilot Nils Söderberg as a personal hack, although it was overweight and little-used.***

I could not retain control of the stick. When I turned around, I noticed that the fuselage was breaking apart, with the elevators flapping up and down. I prepared to bale out, but it was not easy to retrieve my parachute. When I stood up on the edge of the seat in the violent draught of the passing air, attempting to pull the cumbersome parachute upwards, the aeroplane began to slowly pull out of the dive, resulting in reduced vibrations. When standing up, my body functioned as a brake, and straightened up the aeroplane. Both the aeroplane and I got down in one piece, but following this episode the aeroplane was struck off charge. I refused to continue using the Heinecke parachute."

BIPLANE CONFIGURATION

Having been tried twice and having failed twice, the parasol-wing fighter configuration was abandoned. Designers Kjellson and Malmer turned to the biplane configuration instead. The damaged fuselage of the J 24 was repaired, with a set of biplane wings being ordered on February 13, 1925. By that October, the J 24B, as it had been redesignated, was complete, and the machine's serial was changed to 5121.

Initial flight testing showed that the J 24B flew well, but that it was decidedly overweight. No further J 24Bs were ordered, with Flygkompaniet ordering ten Nieuport 29C-1s from France instead. It is also of some interest that the Phönix D III was ordered into production in 1925.

The sole J 24B was subsequently handed over to Nils Söderberg, for use as a personal runabout. In the event, Söderberg rarely flew it. When *Flygvapnet* (Royal Swedish Air Force) was established on July 1, 1926, the J 24B was one of the aeroplanes transferred from Flygkompaniet, but no Flygvapnet type-designator was assigned to it. Ultimately, the J 24B led an undistinguished life, being largely forgotten until it was formally struck off charge on July 7, 1931.

FVM J 23 & J 24B DATA

	J 23	J 24B
Powerplant	1 x 185 h.p. BMW IIIa water-cooled inline engine	1 x 300 h.p. Hispano-Suiza water-cooled inline engine
Dimensions		
Span	11·24m (36ft 10½in)	9·0m (29ft 6½in)
Length	6·90m (22ft 7½in)	7·25m (23ft 9½in)
Height	2·55m (8ft 4½in)	3·03m (9ft 11⅓in)
Wing area	18m² (194ft²)	24m² (258ft²)
Weights		
Empty	771kg (1,700lb)	883kg (1,947lb)
Loaded	985kg (2,172lb)	1,216kg (2,681lb)
Performance		
Max speed	209km/h (130 m.p.h.)	223km/h (139 m.p.h.)

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"Any new book from the European Airlines stable is much to be welcomed, for they set a standard that is extremely high for what are in effect self-published volumes".
Ben Dunnell, Aeroplane, February 2020

ROYAL VIKINGS
The Saga of Scandinavian Airlines

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One of the best books this year coming out at **European Airlines** will be this book about the Scandinavian Airlines System and its predecessors. One hundred years ago, a small Danish company, DDL, began a scheduled passenger service from a naval station in Copenhagen. Sweden with ABA, and later DNL in Norway, also developed significant air links with the rest of Europe. The occupation of Denmark and Norway, during the Second World War disrupted services for a time, but soon after peace returned, putting cultural, geographic and economic issues aside, the three airlines combined their resources to establish the world's first cross-border alliance under the name of Scandinavian Airlines System (SAS). 262 pages, 319 photographs, 37 color profiles and numerous logos and tables, letter format, 216x279 mm, fullcolour, hardback.

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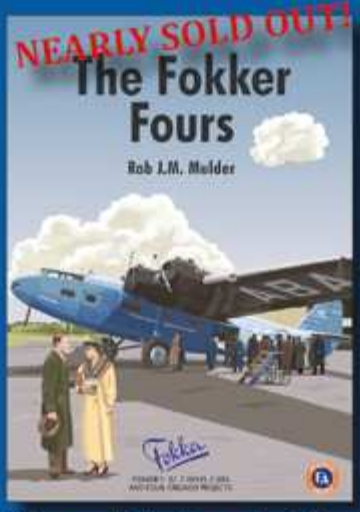

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ARMCHAIR AVIATION

We take a look at what's available for the aviation history enthusiast in the world of books and other literature, from hot-off-the-press publications to reissued classics

Black Tulip: The Life And Myth of Erich Hartmann, The World's Top Fighter Ace

By Erik Schmidt; Casemate Publishers, The Old Music Hall, 106–108 Cowley Rd, Oxford OX4 1JE; 6in x 9in (156mm x 229mm); hardback; 212 pages, illustrated; £25. ISBN 978-1-612008-24-0

BASED ON LUFTWAFFE records, Erich Hartmann is the world's highest-scoring fighter ace, credited with 352 aerial victories; a rate of one "kill" for every 3·99 missions. It is therefore mildly surprising that it has been 50 years since the last in-depth biography of Hartmann.

According to its jacket this book promises an "even-handed" study, using "present-day research and rich historical context". In terms of approach and structure this is not a conventional aviation biography in as much as it is not a chronological passage through its subject's life; as Schmidt says, "You can obtain one of those elsewhere". Rather, the author seeks to write as a commentator on the Nazi period and uses Hartmann as his index with which to deal with a range of historical topics. He also makes his position clear over how he views Hartmann's "fawning early biographers". But in this respect the author perhaps overlooks, with comfortable hindsight, the fact that the American writers to whom he refers were, in the late 1960s, trying to "reach out" to their former enemies at a time when the Cold War was still very cold and the threat of Soviet aggression still a prospect. There was some need to court old foes, to bring them in from the cold — not make "new old" enemies. And if the writing of these biographers was colourful and even fawning, well, so what? Books such as *The Blond Knight of Germany*, Hartmann's first biography, aroused my own interest, and that of many thousands of others of my generation, in the history of World War Two.

Schmidt starts by contemplating Hartmann's early boyhood in China, where his father practised medicine for a brief period, as perhaps giving the future pilot a wider mental horizon compared to his German contemporaries, whose boyhoods would be seized by the Nazis. To reach conclusions over what moulded Hartmann's cognitive traits, he assesses and moralises over the German "heroic" mentality, and the influences that von Bismarck, Hitler and their use of ancient German folk legends had upon that mentality. Schmidt makes some effort in promoting, as a historical and contextual conclusion, that young Germans in the 1930s had their youth stolen by the Nazis; that in Nazi policy there was no room for individuality in academic or social education — which is correct. But having advanced this premise, the author then seems to question the entirely understandable view that Hartmann was "just" another product of it before his career in the Luftwaffe: in Schmidt's opinion, "it is not enough to say that Hartmann was part of the system and therefore must have fully adopted it. That attempt at clarity is just as shallow as saying he was never influenced by any of it, no matter what the policies said".

One chapter discusses the commencement of Operation *Barbarossa* in 1941, but it follows a chapter in which the author already describes the Eastern Front and Hartmann's "kill" record. Another oddity is the extended biographical detail of a Messerschmitt Me 163 pilot to portray the standard of new, poorly trained pilots being rushed into Luftwaffe fighter units in 1945; but the pilot in question had no connection to Hartmann or his Geschwader, JG 52.

The author covers the period Hartmann endured in Soviet captivity, from which he was not released until 1955, in good detail and he also presents intriguing evidence of Hartmann's views on the Holocaust. The remainder of the book covers Hartmann's later years flying Sabres, his well-founded concerns over the Luftwaffe's use of the Lockheed F-104G and then the author's views on Hartmann's possible sympathies for, or association with, far-right

ideology. In this he also brings in figures such as Adolf Galland, Heinz Knoke and the books they wrote as illustrations for his argument.

One thing puzzled me with this book — why Hartmann especially? Why not Rudel (whose reputation is much more controversial), or Hajo Herrmann, the bomber pilot who advocated extreme aerial tactics and later acted as David Irving's lawyer? Or some of the nightfighter aces who used the cold-blooded weapon known as *Schräge Musik* to blast their victims dishonourably from the sky? Why not a U-boat ace, or any number of Waffen-SS men? Why not a collection of such personalities?

A shortcoming is the photograph selection: there are just two photos of Hartmann in the book and the rest are peripheral, including an MG 42 machine-gun and a blurry picture of a Messerschmitt advertisement — and nearly all are public domain or taken from Wikimedia Commons. If you are looking for new, revelatory, first-hand anecdotal or freshly researched archival information on Hartmann's life and service career, you won't find it here. If you are attracted to the idea of a book that attempts to explore, lucidly, the Nazi period German serviceman's mindset and which uses Hartmann as its fulcrum, then this might appeal.

ROBERT FORSYTH

The Aviation Department of the Royal Museum of the Armed Forces and Military History: 145 Civil and Military Aircraft

By Charlie de la Royère; Éditions pat.H, 30 Rue de l'Enseignement, 1000 Bruxelles, Belgium; 8¼in x 12in (210mm x 305mm); hardback; 216 pages, illustrated; €35. ISBN 978-2-930639-31-4

THIS IS AN updated and corrected second edition of the complete directory of the impressive collection of aircraft in the *Hall de l'Aviation* of Belgium's *Musée Royal de l'Armée et d'Histoire Militaire* in Brussels. Presented in three languages, including English, it contains a history of the museum and individual histories of all the aircraft in this unique collection, each type having a page devoted to it, including a colour image and data table. In some cases, unfortunately, the rather rigid layout has resulted in images being drastically trimmed, but the general impression is good.

Rarer aircraft in the collection include a Halberstadt C V, a Sopwith 1½-Strutter, a Nieuport 23C-1, an Hispano-engined Royal Aircraft Factory R.E.8 and the singular César Battaille Triplane of 1911, which had two variable-incidence wings. In addition, audio-visual content has been made available, enabling readers to contribute images online (free of charge) to provide an unprecedented "augmented reality" source of material for modellers, collectors and historians.

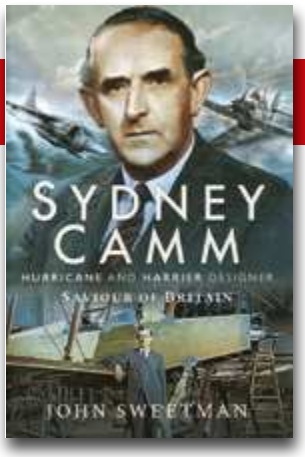
PHILIP JARRETT

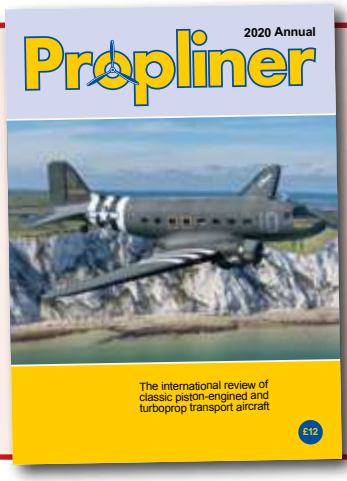
Royal Flying Corps Kitbag: Aircrew Uniforms & Equipment From The War Over the Western Front in WW1

By Mark Hillier; Frontline Books, Pen & Sword, 47 Church Street, Barnsley, South Yorkshire S70 2AS; 7½in x 9¾in (165mm x 241mm); hardback; 268 pages; illustrated; £25. ISBN 978-1-526752-99-4

MARK HILLIER IS an established aviation historian and Stearman pilot who has written *The RAF Battle of Britain Pilot's Kitbag* and a companion volume on Luftwaffe pilots' equipment *[see* Books in Brief, TAH30 *— Ed.]*. These gave an insight into the lives of these men that complemented the accounts of their operations and their aircraft. Now he has turned his attention to their Great War forebears.

This is a well-produced volume with clear





colour photographs interspersed throughout the text, showing surviving equipment and clothing in museums or private collections, along with contemporary photos of the items in use. The text is informative and concise, with extracts from relevant personal accounts.

Inevitably, the longest chapter is on flying clothing, but there are also chapters on flying equipment (maps, map boards, personal weapons, watches etc), uniforms, badges and paperwork. Many enthusiasts will be able to recognise an RFC "Maternity Jacket", or a Sidcot flying suit, but without a book such as this, for most of us a jacket or a helmet would be just a jacket or helmet. Several styles of such items were available; a new pattern did not necessarily mean that the previous one was withdrawn, so several styles might be worn by men of the same unit. It is surprising that this was officially sanctioned; possibly because the aviation service was in its formative years without established traditions, and standardisation was not a wartime priority then. Many flying personnel bought their own flying kit, which added further to the variety.

The book's subject is limited strictly to kit used over the Western Front, essentially covering the RFC. It is a shame that the Royal Naval Air Service (RNAS) is not also included (especially as it did have squadrons on the Western Front too), but, as the author says, that would fill a book on its own. The principal point to note is that the RNAS used black leather rather than the RFC's brown.

The RFC Full Dress uniform and Mess Dress are described but not illustrated. However, there is a chapter on transitional RAF uniforms from April 1918. The RAF originally used the same khaki as the RFC, then briefly tried an unpopular light blue, before adopting the blue-grey with belted jacket that it has used since.

There is a balanced account of the parachute issue. There are a handful of typos and errors; the only real howler is the naming of the Siddeley Puma engine as "Hawker Siddeley".

This has to be the definitive book on the subject and it is thoroughly recommended for all enthusiasts with a more than basic interest in First World War aviation.

ADRIAN ROBERTS

Sydney Camm: Hurricane and Harrier Designer — Saviour of Britain

By John Sweetman; Air World, Pen & Sword, 47 Church Street, Barnsley, South Yorkshire S70 2AS; 6½in x 9¼in (165mm x 241mm); hardback; 320 pages, illustrated; £25. ISBN 978-1-526756-22-0

THIS EXCELLENT BOOK by John Sweetman at last fills a major gap in the published histories of British aviation, in particular of Hawker Aircraft Ltd. There have been previous books on Sydney Camm but they were more about his designs than the man himself. This book concentrates on the man, his family life, how he worked with his staff at Kingston, how he collaborated with senior engineers at suppliers such as Bristol Engines and Roll-Royce, and how he used his reputation to persuade officials in the UK government ministries and armed forces to support his projects.

All of Camm's life is covered, from his birth in Windsor to his death at Richmond Golf Club. The story takes in Camm's membership of the Windsor Model Aeroplane Club, through his apprenticeship and work with Martin and Handasyde Aviation to the H.G. Hawker Engineering Co, Hawker Aircraft Ltd and Hawker Siddeley Aviation. The author has clearly undertaken several years of meticulous research, as the eight-page bibliography testifies. He has spoken to Camm's relatives and to people who worked for him; he has read letters and papers in private collections and has referred to books, published and unpublished

Propliner — The international review of classic piston-engined and turboprop transport aircraft

Edited by Tony Merton Jones; 8¼in x 11¾in (210mm x 297mm); softback; 160 pages, illustrated; £12 inc p&p in UK, available direct from Propliner Aviation Magazine, Penn Farm, Luppitt, Honiton, Devon EX14 4RX. Website www.propliner.co.uk

ORIGINALLY LAUNCHED in 1979 by *Flight International* photographer and propeller-driven-airliner devotee Stephen Piercey (who tragically died, aged just 26, in a flying accident at Hanover Air Show in 1984), *Propliner* magazine was published as a quarterly under the editorship of Tony Merton Jones until 2015, when he decided to call it a day after three decades of sterling effort. But then, in 2016, by popular demand, Tony brought *Propliner* back as an annual — and it looks set to continue to thrive for many years to come. This year's meaty offering comprises three news sections, covering Europe, North America and the rest of the world; and 21 feature articles — ranging from a history of Silver City Airways' years based at the grass airfield of Lympne in Kent to de Havilland Herons in Australia's Outback, by way of D-Day 75th anniversary Dakotas, Brazilian Viscounts, airlines in India, DC-6s in Alaska and much more. Written by an authoritative array of authors, and gloriously illustrated with well-reproduced colour and black-and-white photographs, this fine publication continues to reflect the unquenchable passion for, as Tony puts it, "those classic airliners of a bygone age, that once dominated the world's air routes but have long since been relegated to less glorious work". **MO**

material and to newspapers, periodicals and journals — no stone has been left unturned.

This well-produced 320-page book is essential reading for those interested in aviation history and the men who made Britain a world leader in aircraft design and innovation. As John Sweetman shows, Camm's work was crucial to the survival of Britain, and therefore of western democracy, during the Second World War.

CHRIS FARARA

Under B-Conditions: British Manufacturers' Trials Aircraft Since 1929

By Doug Revell with P.H. Butler; Air-Britain Publishing, available via www.air-britain.co.uk; 8⅛in x 12in (216mm x 305mm); hardback; 208 pages; illustrated; Air-Britain members £27.50, non-members £39.50. ISBN 978-0-851353-4-9

IT IS NOW more than 40 years since the publication of Doug Revell and Phil Butler's invaluable small-format booklet on B-Conditions markings, published by the Merseyside Aviation Society (MAS) way back in 1978. *TAH*'s copy is now somewhat battle-weary, with yellowed pages, ripped corners, smudged thumb-prints and numerous coffee stains attesting to its indispensability over the years. So it is extremely welcome to see Air-Britain give this "must-have" tome its customary "Rolls-Royce" treatment, turning the original 103-page card-covered stapled booklet into a handsome 200+-page hardback stuffed to the rafters with numerous tables and hundreds of photos, many in colour.

I say "must-have" because B-Conditions markings — applied to British aircraft for experimental and test flights before the award of a Certificate of Airworthiness — have never been the subject of an official register, and the only key to unravelling their identities for researchers up until now has been the MAS booklet, a testament to the magnificent researching skills — and sheer determination — of its authors.

The result of decades of painstaking further research and detective work, this new edition provides chapter-and-verse on the history of B-Conditions markings, which, by their nature, offer a parallel history of the development of British aviation. They were first introduced by the Society of British Aircraft Constructors (SBAC) in 1929. Various systems have been used since then, all of which are detailed in this new version, but the rules governing their use remain essentially unchanged. Forerunners of B-Conditions markings were the "X-Numbers" issued during 1917–19 to British private-venture aircraft whose construction had been authorised by the government, but were not financially supported by an official contract; the details of these are included here, as are the "H.P. Numbers" allocated to civil conversions of Handley Page O/400s which had not been completed and which had no military serials.

After an informative and excellently illustrated opening introduction to the B-Conditions system and its markings, the book is divided into three main chapters detailing "The Initial System", "The Post-War System" and "Into the New Millennium", each of which presents the relevant information about each manufacturer, in alphabetical order, using Air-Britain's classic no-nonsense style of (considerately!) legible tables and well-reproduced photographs.

Although perhaps not a great bedtime read, this is what Air-Britain excels at, gathering together difficult-to-find historical aviation data and presenting them in a user-friendly and attractive package. The organisation's work is important for the preservation of information and material relating to our subject, and becoming a member will help Air-Britain achieve that objective. It will also get you nearly a third off this splendid updated "must-have" book.

NICK STROUD

BOOKS IN BRIEF

A quick round-up of what else is currently available for the aviation history enthusiast

AERIAL OPERATIONS IN THE REVOLUTIONS OF 1922 & 1947 IN PARAGUAY
Antonio Luis Sapienza
Helion & Co; ISBN 978-1-912390-58-8; £16.95

REGULAR READERS of these pages will know that we are big fans of Helion's *Latin America @ War* strand, and this, the eighth in the series, offers a fascinating look at the use of air power during two of the South American nation's numerous revolutions. The first, in 1922, saw government and rebel forces take each other on in a small collection of biplanes, mainly imported Italian Ansaldos. The second, in 1947, was a more modern affair and saw the use of mainly American types, including PT-19s, BT-13s and AT-6s. With good maps, excellent photos and six pages of colour profiles by J.P. Vieira, this is a fine addition to the series. **NS**

YEADON ABOVE AND BEYOND
Kenneth B. Cothliff
Air Supply Publishing; ISBN 978-1-5272-3512-0; £19.99

AN UPDATED version of the same author's *Yeadon Above The Rest,* published in 2011, this 330-page softback is subtitled *The Illustrated History of Leeds Bradford Airport.* Its remit actually extends beyond the airport itself, to encompass a general history of aviation in the Leeds area going back to 1909, more than two decades before Yeadon's official opening as a municipal airport in 1931; there is also a brief introductory nod to Yorkshireman Sir George Cayley's aeronautical experiments in the mid-1800s. The airport has played an important role in the development of the Yorkshire/Northern England region as a powerhouse of industry. Incidentally, the author points out that Yeadon is the UK's highest operational airport, at an elevation of 681ft (208m) above sea level, more than 200ft higher than any other active civil or military airfield in the British Isles. **MO**

WARPAINT No 125: BRISTOL BRITANNIA
Charles Stafrace
Guideline Publications; no ISBN; £16

ONE OF THE last of the propliners, the Bristol Proteus-powered "Whispering Giant" oozes character and stage presence. First flown in 1952, the Britannia entered service with BOAC in 1957 but suffered continued problems with its turboprop powerplants — *TAH* author Roger Carvell characterised it as "Around the world in 80 delays". This useful monograph also covers its RAF use and the licence-built Canadair Argus and Yukon. **MO**

HENSCHEL Hs 129: PANZERJÄGER
Martin Pegg
Chandos Publications; ISBN 978-1-999316-50-1; £60

ORIGINALLY PUBLISHED by Classic Publications in 1997, Martin Pegg's magnum opus on the Luftwaffe's pugnacious ground-attack aircraft quickly became a highly sought-after item, and this substantially updated edition has been made available by Rich Carrick's Chandos Publications. An object lesson in how to put together an exemplary monograph, this is the only book you will ever need on the type. At £60 it's not cheap, but, printed on excellent paper with superb repro and jam-packed with the results of exhaustive research, this 8½in x 12in hard-back is "reassuringly expensive". Numbers are limited, so our advice is to get a copy while you can. **NS**

BATTLE OF THE ATLANTIC 1939–41
Mark Lardas
Osprey Publishing; ISBN 978-1-472836-03-8; £14.99

THE 15th in Osprey's well-appointed *Air Campaign* series, this 96-page 7½in x 9¾in softback is the first half of author Mark Lardas's two-part account of the deadly cat-and-mouse game that saw the tide of war ebb and flow for both sides throughout the Second World War. Tracing the early days of the battle for the initiative in the Atlantic, this readable and typically well-produced volume is divided into seven chapters incorporating numerous photographs (most of which are rather flat in this case), helpful maps reproduced at a legible size and good explanatory diagrams. The artworks spread across the spine work rather less well, however. **NS**

THE LUFTWAFFE IN AFRICA 1941–1943
Jean-Louis Roba
Casemate Illustrated; ISBN 978-1-612007-45-8; £19.99

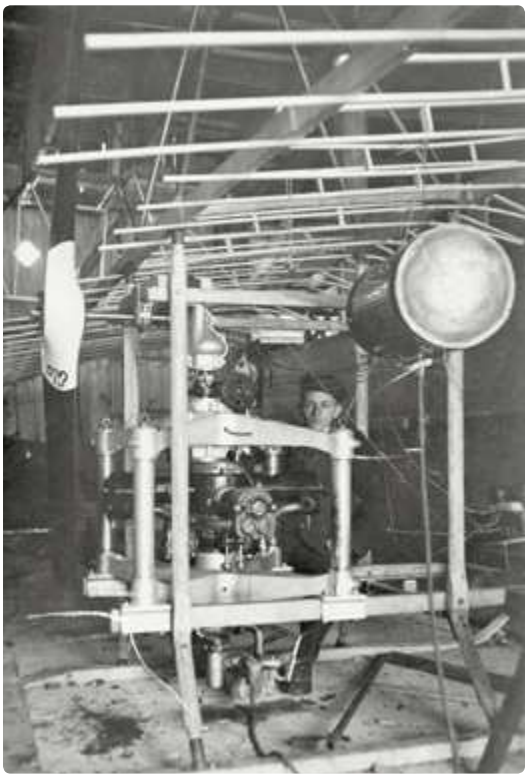
ONE SUSPECTS AN attempt to park tanks on Osprey's lawn: Casemate's "Illustrated" series uses roughly the same presentation and dimensions as the former's tried-and-trusted softback format, this example by Luftwaffe specialist Jean-Louis Roba chronicling the German air arm's wartime adventures in Africa before being thrown back into Italy in 1943. More of a broad overview than a detailed history, this copiously illustrated 7in x 10in softback is more expensive than an Osprey, but not quite up to the latter's high standards yet. **NS**

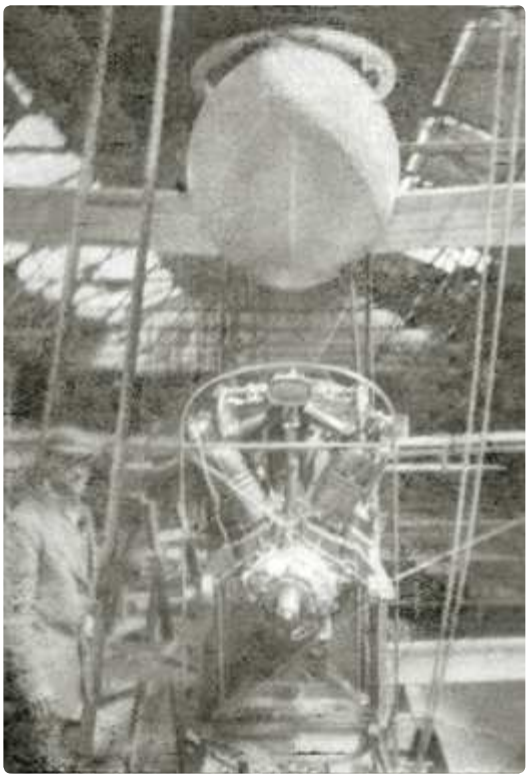
Lost & Found

***PHILIP JARRETT** explores the lesser-known corners of aviation history, discovering little-known images and rediscovering long-lost details of aircraft, people and events. This time he presents a pair of enigmatic European postcards from before World War One*

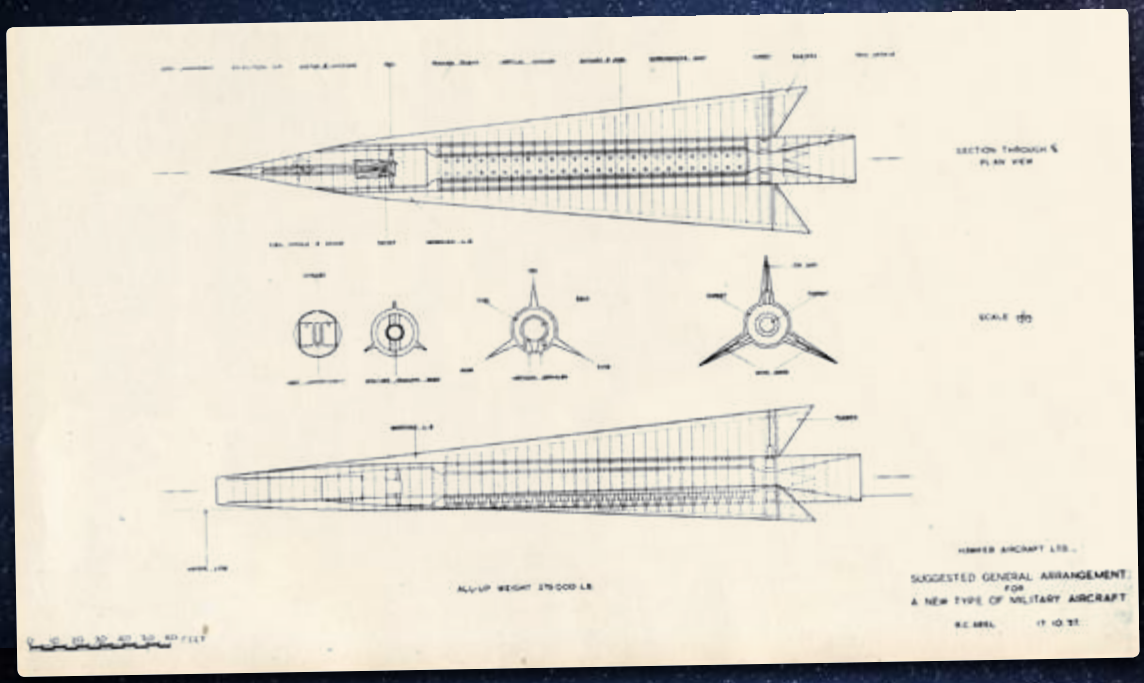
TWO MYSTERY European aircraft from the pioneer era are featured in *Lost & Found* this time, in the hope that readers might be able to identify them and rescue them from obscurity. The first, from a German postcard, shows a young man posing in an incomplete machine which has an interesting powerplant installation. Its air-cooled radial engine is mounted horizontally, with the driveshaft rising vertically to a gearcase containing bevel gears, that turn the thrustline through 90° to drive a large-diameter two-bladed "Eta" pusher propeller rotating in a cut-out in the trailing edge of a high-set wing. There is no sign of a lower wing, which suggests that the aircraft is a monoplane. Wheels are yet to be fitted to the twin-skid undercarriage. Whether the fuel tank in the right foreground is in its intended final position or merely temporarily rigged for ground running is not known, but the latter seems likely.

The second image, from a faded and fuzzy original print of French origin, possibly of a slightly later date, depicts a large water-cooled vee-cylindered inline engine installed well below the nacelle of what might be a biplane or triplane. The exact form of the structure is difficult to determine owing to the profusion of struts and ropes, not all of which are part of the machine's structure. Again, it is a very unconventional arrangement and quite distinctive, if only it can be identified. Any information which may help solve the mystery to the Editor, please!





ABOVE LEFT ***The central structure of a German high-wing monoplane (?), showing the unconventional powerplant installation.*** **ABOVE RIGHT** ***This French creation has a nacelle for the pilot positioned high above a vee-cylindered inline engine. One wonders how the occupant(s) gained entry into the cockpit (and indeed, if they wanted to at all!).***



HAWKER'S STAR DESTROYER

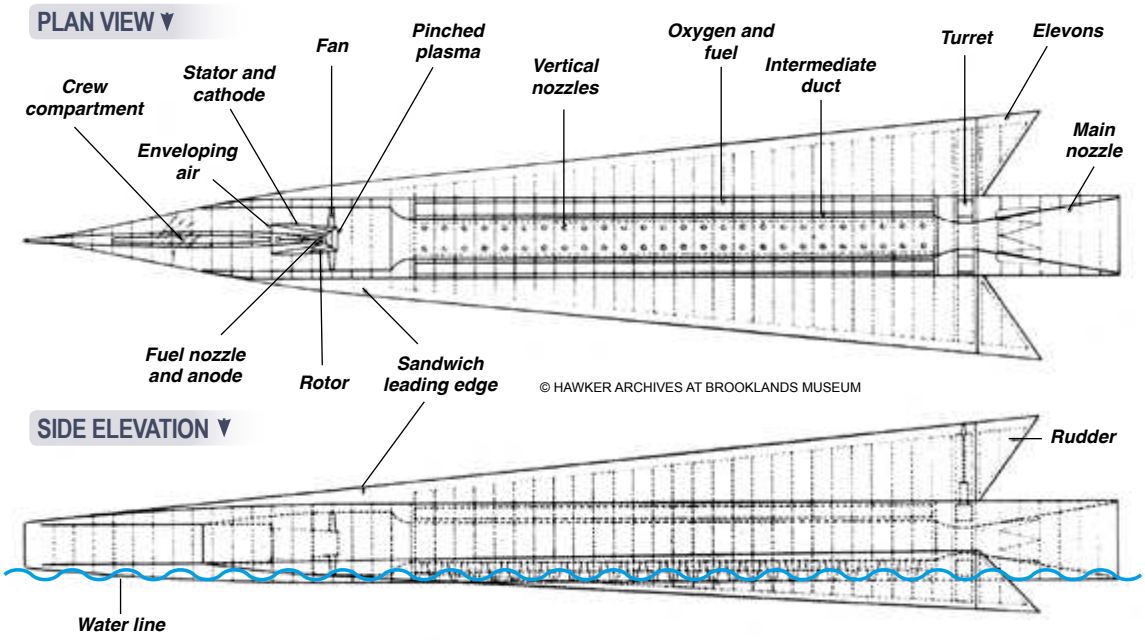
On a recent dig through the archives at Brooklands Museum, CHRIS GIBSON discovered a technical illustration showing what looked initially like an unfamiliar design for a missile; closer inspection, however, revealed that its proposed size was *massive*. Furthermore, it was to be powered by means of "pinched plasma"...

A MASSIVE TRIANGULAR craft passes overhead, progressively filling your field of vision as it slows to a hover before descending into the sea in a cloud of water vapour. This is not a long time ago in galaxy far, far away but the Solent, mid-1960s.

A NEW TYPE OF MILITARY AIRCRAFT?

While researching guided weapons (specifically ramjet-powered stand-off missiles) at Brooklands Museum recently, I came across a drawing (**TOP**) of what at first glance looked like a missile with a pitot intake and three long aerodynamic surfaces. Closer examination revealed some interesting annotations to the drawings, starting with the title — "Suggested General Arrangement for a New Type of Military Aircraft" — and that it had been drawn by Mr R.C. Abel of Hawker Aircraft Ltd, Kingston, on October 17, 1957. The first clue that this was something other than a missile to mount on a V-bomber was the scale bar — 60ft (18·3m) rather than the expected 6ft (1·83m). A ruler and a bit of mental arithmetic gave a total length of 275ft (83·8m). This beast is BIG — similar in length to an Antonov An-225 Cossack — and with an all-up weight of 275,000lb (124,700kg), on a par with a Boeing 757 airliner.

With the large print examined, it was time to



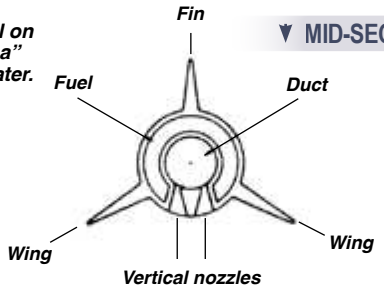
ABOVE ***The drawing by R.C. Abel includes a good amount of detail on the huge craft's layout and systems, including the "pinched plasma" powerplant and the 52 rocket nozzles for VTOL operations from water.***

dig out my trusty geologist's hand lens and look at the small print. The first words that caught the eye were "Water Line". So it's a flying-boat. Different, but not that unusual for a time when large aircraft had been flying-boats, a prime example being the Saro S.R.45 Princess, three airframes of which were then mothballed at Cowes and Calshot.

The cross-sections on the Hawker drawing show that the crew compartment was to be housed in the intake splitter. Although no mention was made of the number of crew, the compartment was less than 6ft (1·8m) wide, suggesting tandem seating. The intake implies that it is an air-breather, so we shall turn to the propulsion system which is where this new aircraft type becomes . . . interesting.

A PLASMA ENGINE

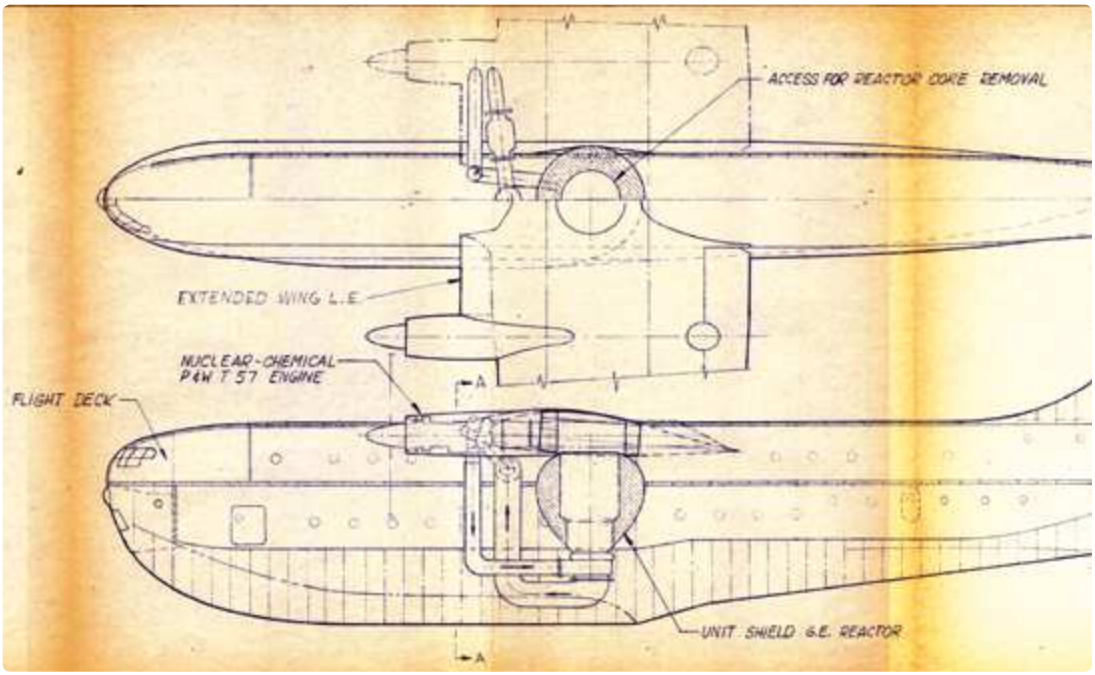
The annotations for the inboard section drawing show some fairly conventional — if unusual — items, such as nozzles for 52 rocket motors that are arranged in pairs along the undersurface, plus the tanks for liquid oxygen and fuel, although no specific fuel is mentioned. These rocket motors would have provided the aircraft's vertical take-off and landing (VTOL) capability, allowing it to alight on water. A fan and a stator are shown inside the intake duct, connected to a main nozzle at the rear by an intermediate duct. The fan and stator would no doubt compress the incoming air before it entered the intermediate duct, where fuel was added



ABOVE ***The illustration incorporates several section drawings of the proposed machine, including this section roughly halfway along the main fuselage. The author also uncovered a number of other Abel designs, including one for the "P.1151" — a four-engined version of the unbuilt P.1129 strike fighter.***

for combustion with the working fluid passing through the main nozzle to produce thrust. Closing the nozzle would divert the working fluid through the 52 rocket nozzles to produce lift. All fairly normal for 1950s design studies at a time when almost every aircraft was to possess VTOL capability. Where the annotations diverge from conventional is the use of some very non-aeronautical terms such as "anode", "cathode" and "pinched plasma".

Plasma is a familiar term today, describing an ionised fluid that is neither gas, liquid nor solid. "Pinched plasma" required further research. A "pinch" is the compression of an electrically conducting substance, usually plasma, by the use of magnetic forces within a toroidal (doughnut-shaped) reaction vessel. Later known by the Russian name *"tokamak"*, such vessels have since become a key component of a fusion



VIA SCOTT LOWTHER

ABOVE ***A colour-reversed section of a 1958 Convair blueprint detailing the incorporation of a nuclear powerplant into a Saro Princess flying-boat. Convair was to provide the reactor and heat exchangers; the aircraft was to use Pratt & Whitney T57 engines, which could use either conventional fuel or heat from the reactor's heat exchangers.***

reactor. (While fission reactors have generated power for decades, a practical fusion reactor has been 30 years away for the last 60 years.)

This was all very futuristic, and the date on the drawing, October 1957, may help explain the background to Abel's design. Two ostensibly unconnected events occurred during 1957, both of which may have prompted Abel's drawing. In April 1957 the *Defence White Paper Outline of Future Policy,* which has since become infamous as the "Sandys White Paper", was published. No need to explain this to *TAH* readers, but suffice to say Sandys' paper led to many operational requirements being cancelled and work on the associated aircraft scrapped, leaving the aircraft companies looking for new designs.

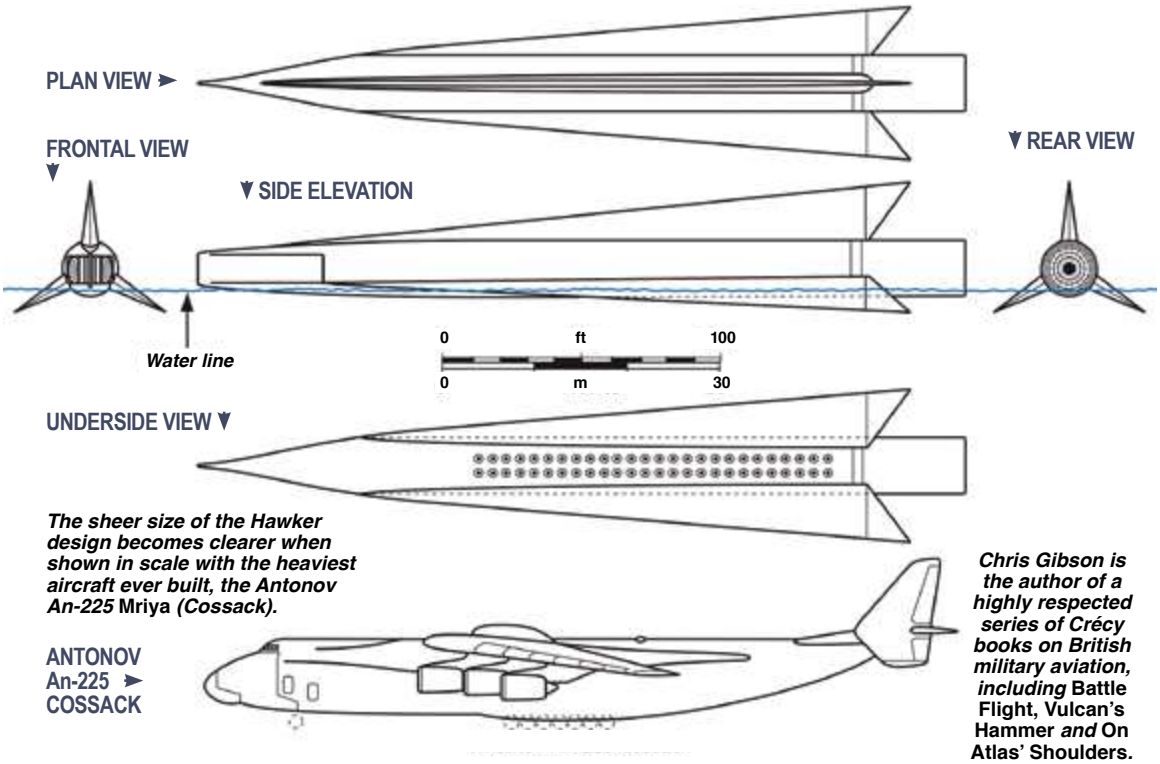
The other event was a September 1957 leak to British newspapers that revealed the existence of the Zero Energy Thermonuclear Assembly (ZETA). Developed by the Atomic Energy Research Establishment (AERE) at Harwell in Oxfordshire, ZETA used the pinched plasma confinement technique with a toroidal vessel surrounded by a large magnet that induced the pinch. The initial (leaked) information on ZETA suggested that fusion had occurred, and that unlimited power was just around the corner. Further work and a review issued in January 1958 concluded that ZETA had in fact not produced nuclear fusion reactions.

THE NUCLEAR OPTION

Meanwhile, in the more practical world of nuclear fission, the major powers had been examining nuclear-powered aircraft. The USAF had studied nuclear propulsion systems for aircraft, flying the Convair XB/NB-36H with an onboard fission reactor under the Aircraft

BELOW ***By the mid-1950s the concept of nuclear-powered aircraft had been converted into hardware in the USA, the sole XB/NB-36H making its first flight with a nuclear reactor aboard on July 20, 1955. The aircraft completed 89 flying hours with the reactor operational, but only for shielding trials; the reactor was never used for motive power.***

USAF



The sheer size of the Hawker design becomes clearer when shown in scale with the heaviest aircraft ever built, the Antonov An-225* Mriya *(Cossack).

Nuclear Propulsion programme from September 1955 until March 1957. *[See Jakob Whitfield's* Radiant Skies *in* TAH4 *— Ed.]* In 1961 the Soviet Union flew the Tu-95LAL *Letayushcaya Atomnaya Laboratoriya* (Flying Atomic Laboratory), a *Bear* bomber with a reactor in its bomb bay. Not to be left out, the US Navy, also working with Convair, sought a nuclear-powered aircraft; and, lacking a suitably-sized type, looked across the Atlantic to the three Saro Princesses mothballed on the Solent. Convair proposed converting these to nuclear power by adding a pair of nuclear/conventional Pratt & Whitney T57 turboprops with additional heat exchangers to provide heat in lieu of combustion chambers once the aircraft was in the cruise.

In August 1956 the UK Air Staff had issued Air Staff Target AST.340 and by 1957 British engineers were also examining nuclear power for aircraft. The Hawker Siddeley Nuclear Power Company Ltd (HSNPC) had drawn up a proposal that shared its configuration with the Avro Type 730, with a lightweight reactor in the fuselage to provide heat to the wingtip-mounted turbojets. A summary of this work, with illustrations and penned by E.P. Hawthorne, HSNPC's Chief Engineer, was published in the March 1958 edition of *Enterprise*, de Havilland's in-house magazine. A major component of the Hawker Siddeley Group, de Havilland's Nuclear Power Group had developed lightweight ceramic fuel elements with a possible application in airborne reactors.

FUSION: THE HOLY GRAIL

So how are all these related? The possible connection is Sandys, who had a penchant for high technology — and in October 1957 there was nothing more hi-tech than fusion power. An aircraft so powered would be a major advance on anything on the drawing board at that time — a period when the UK aviation industry aimed to leapfrog its international competitors. It is reasonable to assume that as Sandys had just cancelled most of Hawker's work, a quantum leap was really what it would be looking for. Perhaps that was Abel's remit, and such applications of future technologies has always been the work of what became known as advanced projects departments in the aircraft companies around the world.

And what of Mr Abel, whose brainchild this evidently was? He was a designer in the Hawker design office and worked alongside Ralph Hooper, the designer of the P.1127, which ultimately begat the Harrier. In conversation with former Hawker engineer and now keeper of the company's archives at Brooklands, Chris Farara, Hooper said that Abel "produced a number of preliminary designs for astonishing aircraft" — and what could be more so than Hawker's "Star Destroyer"?

ACKNOWLEDGMENTS *The author would like to thank Chris Farara at Brooklands Museum and James Jackson for their invaluable assistance with the preparation of this feature*

***Chris Gibson is the author of a highly respected series of Crécy books on British military aviation, including* Battle Flight, Vulcan's Hammer *and* On Atlas' Shoulders.**

A picturesque location for the final resting place of a dead horse? MiG-23ML Flogger-G *c/n 0390324250, seen here in Baker, Florida in January 2020, may be found on Google Earth by entering the co-ordinates 30°45'17.6"N 86°41'48.1"W.*

OFF THE BEATEN TRACK

Ever turned a corner to find something unexpected? The Aviation Historian's *intrepid aeronautical explorer* **PETER DAVISON** *investigates the stories behind the oddities that turn up in the most unusual places . . .*

WHEN THE BERLIN Wall came down in November 1989, it heralded the departure of Soviet assets from Europe. Among the items "left behind" were 48 examples of the 80 MiG-23 *Flogger* swing-wing fighter-bombers operated by the East German Air Force. Previously based near Peenemünde, these were transferred to the unified Luftwaffe and registered in the 20+ series formerly used for the Luftwaffe's F-104Gs, but were never operated as such.

Many of these MiG-23s now reside in European and American collections, and 12 were initially evaluated and used in the adversary/aggressor role with the USAF's 4477th Test & Evaluation Sqn at Tonopah, Nevada, serving with the USAF under the designation YF-113 well into the 1980s.

PHOTOGRAPHS BY THE AUTHOR

This example, a MiG-23ML *Flogger-G* interceptor variant, is currently marked as "Red 53", but is in fact the former 20+24, c/n 0390324250, previously preserved and displayed at Tyndall AFB in Florida. It now resides beside a minor road in Baker, Florida, outside C&D Disposals, a waste-management contractor, to the north of the Eglin Test Range. Interestingly, the company also holds an ex-Polish Antonov An-2 biplane, N122AN, which appears to be under restoration.

More than 5,000 *Floggers* were built in many variants during 1967–84. Production of the light-weight ML interceptor started in 1978, featuring a radar, HUD, six ordnance hardpoints and a 23mm cannon. The variable-geometry nozzles and after-burning engine gave the *Flogger* an impressive maximum speed of 1,550 m.p.h. (2,500km/h) and a service ceiling of 60,000ft (18,300m).

1940: the battle of kent? / italy's forgotten airlines pt 2 / shorts — the politics / louis blériot / WW2 tunisian air war / heinkel's last fighter / the lockheed jetstar in iran / cierva air horse crash / wartime g-suits / sweden's parasol fighters

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